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THE NORMAL PHASE VARIATIONS OF THE 18 KC/S SIGNALS FROM NBA OBSERVED AT FRANKFURT, GERMANY

A. H. BRADY, A. C. MURPHY, AND D. D. CROMBIE

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THE NORMAL PHASE VARIATIONS OF THE 18 KC/S SIGNALS FROM NBA OBSERVED AT FRANKFURT, GERMANY

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CONTENTS

Page

1. Introduction 1

2. Analysis of Data 2

3. The Diurnal Variation of Phase 3

3.1. Seasonal Variation in Diurnal Phase Change 3

3.2. Variation of Phase with Amount of Illuminated Path 4

3.3. Sunrise 4

3.4. Sunset 5

4. Phase Stability 5

5. Acknowledgment 7

6. References 8

Observations of the normal phase variations of the 18 kc/s signals radiated from the Canal Zone and received in Frankfurt, Germany are given in the form of monthly averages and standard deviations at 5 minute intervals. The relation between mean diurnal phase variations and the diurnal variation in path illumination is shown. The mean diurnal height change is 21 km which is reduced to 20 km during summer and winter and increased to 22 km during the equinoxes. Short term normal phase differences are also briefly discussed.

The Normal Phase Variations of the 18 Kc/s Signals from NBA Observed at Frankfurt, Germany

1. Introduction

There is considerable current interest in the phase stability of VLF signals received over long paths. This interest stems from the use of such signals for the dissemination of standards of frequency, for use in long range navigation aids, and in possible systems for the detection of high altitude nuclear explosions. In the latter case, nuclear explosions produce abnormal phase changes because of changes in the electron density distribution of the lower ionosphere. In order to decide which phase changes are abnormal, it is necessary to know what normal changes are to be expected. Thus, in this note the normal behavior of the phase of the signals received at Frankfurt, Germany at 18 Kc/s from the VLF transmitter NBA in the Canal Zone will be briefly summarized with little, or no attempt at interpretation. This note will be followed by others which discuss the normal behaviour on other paths. It is expected that these will then be followed by papers in which specific aspects of the results from all paths will be considered.

As used in this and subsequent reports, the normal behavior will refer to the average of all useable observations, usually grouped in intervals of a month. Occasions when known solar flares have occurred are excluded. Some results of a separate study of solar flares have been given by Chilton et al (1963).

The data reduced in this way are then used to compute the monthly mean of the phase at 5 minute intervals. The standard deviation of the phase at each time is also computed and recorded. Individual observations which depart from the mean for the particular time by more than one standard deviation were then rejected and the mean of the remaining observations at that time was re-calculated.

Tables 1 - 12 give the results of these calculations for the 12 months of 1962. The tables are arranged so that the values for each half hour occupy one line, at intervals of five minutes. The line for each hour is labelled with the Universal Time of the first entry. The entries in the table are then, reading across the line from left to

right, the arithmetic mean of all values (AVER) at that time for the month, the standard deviation of these values (SDV), and the number of values (NO) which were used. The next two entries are QAV which is the mean after the values departing by more than one standard deviation are removed and the number of values (NO) which were used in obtaining this average. The corresponding figures for each five minute period in the half hour then follow and are denoted by the figures + 5 min..... + 25 min above each group of columns. The thirty minute values then occur at the left of the next line in the table.

Plots of the mean and standard deviation for each month from August 1961 to December 1962 for the NBA-Frankfurt path are given in figures 1 - 3. The quiet means as defined above are shown by dotted lines where they depart from the mean of all observations.

The quiet averages defined above were obtained in an attempt to determine whether the larger deviations from the mean of all values were symmetrically distributed. It will be seen, from tables 1 - 12, that the values labelled "AVER" and "QAV" are essentially equal and thus the larger deviations do appear to be symmetrically distributed. The tables also show that in obtaining QAV about 32% of the original values are rejected. This indicates that the data tend to be normally distributed.

2. Analysis of Data

The phase of the signal relative to a local, stable, reference oscillator is obtained in the form of strip chart records from a servo-type phase measuring system [May and Diede, 1963]. In general, the frequency of the reference oscillator at the receiver differs slightly from the transmitted frequency. Furthermore, it is usually found that this frequency difference is not constant but that over periods of a few days, it is a linear function of time [Crombie et al., 1958]. This then leads to a parabolic variation of phase, with time, which must be removed in order to find the dirunal phase variation.

The chart records are scaled at intervals of 10 minutes (more frequently when the phase is changing rapidly) using semi-automatic means which produce the resultant phase values on Hollerith punched cards. These phase data are transferred to magnetic tape during further processing which removes cyclic ambiguities due to oscillator differences to produce a continuous digital record of the phase.

Another computer process is then used to remove the effects of frequency offset. This is usually done by making a least squares fit of a parabola to the phase values for three consecutive days at hours when the path is fully sunlit. The resulting parabola is then subtracted from all phase values of the center day. This process is repeated for each day, resulting in a continuous calculation of the diurnal phase variation. In the case where a discontinuity is encountered in the data, a straight line rather than a parabola is fitted for two consecutive days. The parabolic variation remains in that case, but in one day with stable oscillators its effects are minor, and its contribution to an average over many days is negligible.

3. The Diurnal Variation of Phase

The monthly mean diurnal phase variations are shown in figures 1 to 3. The left hand scale for each month is the diurnal phase scale. The scale on the right hand margin is the standard deviation of phase scale. Also shown on the diurnal phase curves are the times of sunrise and sunset at a height of 80 km. In calculating these times, it has been assumed that the screening effect of the atmosphere increases the radius of the earth by 30 km.

The curves illustrate the typical trapezoidal shape [Pierce, 1957, Crombie et al., 1958] of the diurnal phase variation. The phase advances when sunrise occurs at the eastern end of the path and continues to advance until the whole path is sunlit. The relative phase then remains approximately constant until sunset occurs on the eastern end of the path. The phase delay then increases until the whole path becomes dark. The duration of the times when the phase is constant varies seasonally with the times for which the path is fully dark and fully illuminated.

3.1 Seasonal Variation in Diurnal Phase Change

The mean diurnal phase change for each month is plotted in figure 4 and suggests that there is a semi-annual cyclic variation in the magnitude of the diurnal phase variation. The standard deviation of the mean for the points shown in figure 4 varies between 4° and 16°, with a mean of 9°. Thus, the differences between months are undoubtedly significant. Fourier analysis yields the annual and semi-annual components which are also shown in figure 4. It seems that the diurnal phase change is a maximum during the

equinoxes and least during summer and winter. On the other hand, the annual variation is too small to be significant. The mean diurnal variation in phase is 460°. This varies seasonally by ±25°. Using the approximate calculation of Wait (1959) relating the diurnal phase change to the diurnal change in the effective height of the ionosphere, it is found that the equivalent diurnal height change is 21 km, which is reduced to 20 km during summer and winter and increased to 22 km during the equinoxes.

3.2 Variation of Phase with Amount of Illuminated Path

It was noted earlier that, overall, the phase variations tend to be proportional to the amount of daylight on the path. In this section, the dependence of the sunset and sunrise variations on the length of illuminated path will be discussed in more detail. To facilitate this, figures 5, 6, and 7 have been prepared. In these, the mean phase variations at sunrise and sunset for the months of September and December 1961 and for March, June, Sept, Dec, 1962, are superimposed on curves which give the percentage of the path in darkness at ground level and at a height of 80 km. The atmospheric screening height is again taken to be 30 km. Thus, the two curves represent solar zenith angles of 0° and 97°. The phase and illumination curves have been fitted by changing the diurnal phase variation scale so that it fits the illumination scale. Thus 100% on the illumination scale also represents 100% of the diurnal variation.

3.3 Sunrise

During March, the sunrise phase change commences at about the time of sunrise at 80 km. After 40% of the path has become illuminated, the phase change begins to follow the ground sunrise line and continues to do so until the path becomes completely sunlit. Similar behavior is shown during June. During September for 1961 (shown in fig. 6) and for 1962 (shown in fig. 7), on the other hand, the phase curve follows the 80 km sunrise curve very closely. This is also true in December for both years except for the first two hours when the phase tends to lead even the 80 km illumination.

The most striking features of the sunrise variation, however, are the periodic phase oscillations which occur. These are particularly pronounced in June. These oscillations have been discussed elsewhere [Crombie, 1963] in some detail. They are believed to be due to interference between two modes excited by the transmitter in the nighttime portion of the path.

3.4 Sunset

During March, the phase lag begins to increase immediately when the sun sets at ground level at the eastern end of the path. The phase initially follows the ground sunset curve and then lags behind both it and the 80 km sunset line. The phase does not reach its limiting value until about 3 hours after the path becomes fully dark. In June, the same behavior occurs. In September and December, the lag of the phase change behind the illumination curves is much smaller, until about 90% of the path becomes dark. There is then a sharp break in the phase curve and it lags much more behind the illumination, and finally reaches the nighttime level about 2 hours after the path becomes completely dark.

The initial lag of the phase variation behind the illumination variation is probably due to slow disappearance of the electrons after the ionosphere at the height in question becomes dark. The later portion of the phase variation suggests, however, that if this is the cause, the recombination coefficient changes markedly, either at the greater heights or at the transmitter end of the path, which is at the lower latitude in this case. It is interesting to note from figures 1, 2, 3, also, that during the winter when the path is dark for the longest time that the phase variation eventually becomes constant, indicating that the nighttime height of reflection becomes constant. Thus, the nighttime reflection height varies in a manner which suggests that the nighttime ionization is not simply due to the decay of the daytime ionization. During June, when the duration of darkness on the path is a minimum, it seems that the true nighttime height is barely reached. This may possibly be the cause of the semi-annual variation shown in figure 4.

In any case, it is clear that the diurnal height (h) does not follow a law of the type

$$h = h_o + H \log \sec \chi ,$$

where h and H are constants, which has been found to hold at vertical incidence [Straker, 1955].

4. Phase Stability

One way of evaluating the significance of a particular phase deviation is to compare it with phase records of adjacent days. The significance of the particular variation can then be assessed in terms

of the ratio of its magnitude to the standard deviation of the mean phase curve which would be expected at the time in question. Since the day-to-day variations are approximately normally distributed, then a disturbance as large as the standard deviation could be expected 68% of the time and could hardly be regarded as significant on this basis alone. On the other hand, a departure from the mean amounting to three standard deviations could be expected 1% of the time and would be very significant.

In view of this, figures 1, 2, and 3 contain the day-to-day standard deviations determined for each month. During daytime hours, the standard deviations of phase range from about 5° during the summer months to about 20° during the winter. The corresponding standard deviations of height range from 0.2 km to 0.8 km. When the path is dark, the standard deviation of phase varies from about 10^{o} (0.4 km) in the summer to 60° (2.5 km) in the winter. It is interesting to note that the increase of standard deviation from day to night is, in most cases, approximately proportional to the increase in length of the dark portion of the path.

The day to day standard deviations of phase are rather large, and for some purposes it may be more useful to have some indication of the average change in phase which can be expected in a time (T) during an individual day. One method of finding this quantity is to find the root mean square difference of all values (when the path is wholly sunlit or dark) separated by the time (T). It can be shown that the value of the RMS difference $[\mathrm{RMSD}_{(T)}]$ is given by

$$\mathrm{RMSD}_{(T)} = \sqrt{2}\ \sigma_T$$

where σ_T is the standard deviation of uncorrelated phase values separated by a time T. Again, for normally distributed data, a particular phase difference will be significant if it is sufficiently larger than the corresponding standard deviation. Values of $\mathrm{RMSD}_{(T)}$ and thus σ_T can be obtained from Tables 1 - 12 by calculating the quantity

$$\mathrm{RMSD}_{(T)} = \sqrt{\left[\frac{n}{m}\sum_{i=o}^{m}(a_i - a_{i+T})^2\right]}$$

where the a_i are the mean phase values entered in the tables, T is the time for which the RMS difference is required, n is the average

number of values used to obtain the mean phase, and m is the number of values of a, which are used. Some representative values of $RMSD_{(T)}$ for T between 10 and 90 minutes are shown in table 13 for the path under discussion. Several interesting features are shown in the table. It is clear that the RMS phase difference increases as the time interval T increases from 10 to 90 minutes, and that a nearly constant value is reached near 90 minutes. Secondly (during the summer), the daytime RMS differences are smaller than when the path is dark, by a factor of 3 to 4, but during the winter there is little difference between them. It is interesting to note also that the January nighttime differences are approximately equal to the July daytime differences.

Although not shown in table 13, the reduction of the phase differences with decreased T continues until T is equal to 5 minutes, at least. Values for T less than 5 minutes have not been examined closely because of the large amount of data involved. However, a visual examination of the original records shows much larger, very short duration phase perturbations which are presumably due to atmospherics. The time resolution on the charts is not adequate to permit accurate determination of the value of T at which the RMS difference is a minimum.

5. Acknowledgment

This work was supported by the Advanced Research Projects Agency under ARPA Order 183. The observations were made by the Battelle Institute, Frankfurt, Germany.

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NBA (18 kc/s, BALBOA, PANAMA) TO FRANKFURT, GERMANY
AVERAGE PHASE FOR AUGUST – DECEMBER 1961

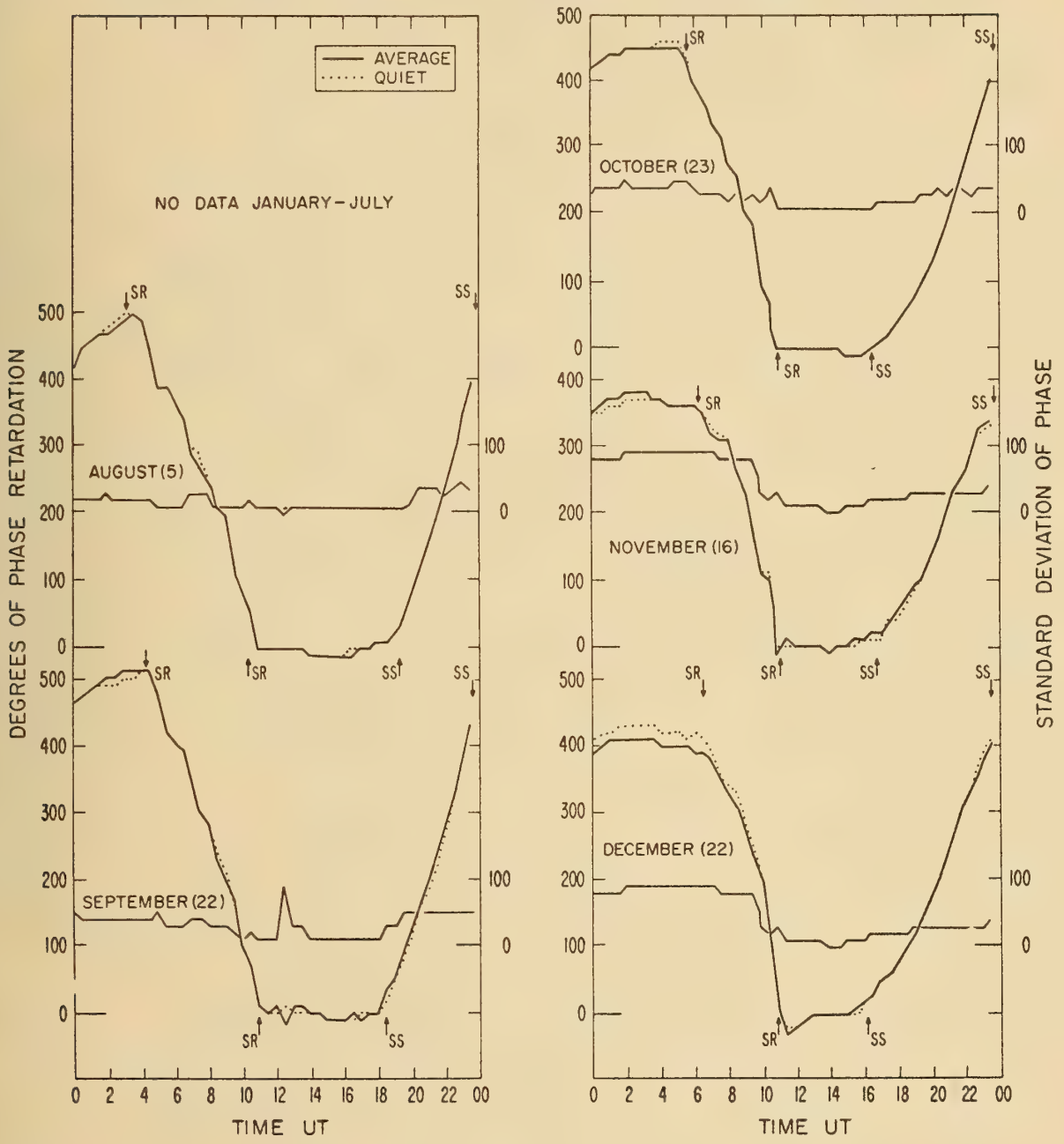

Figure 1

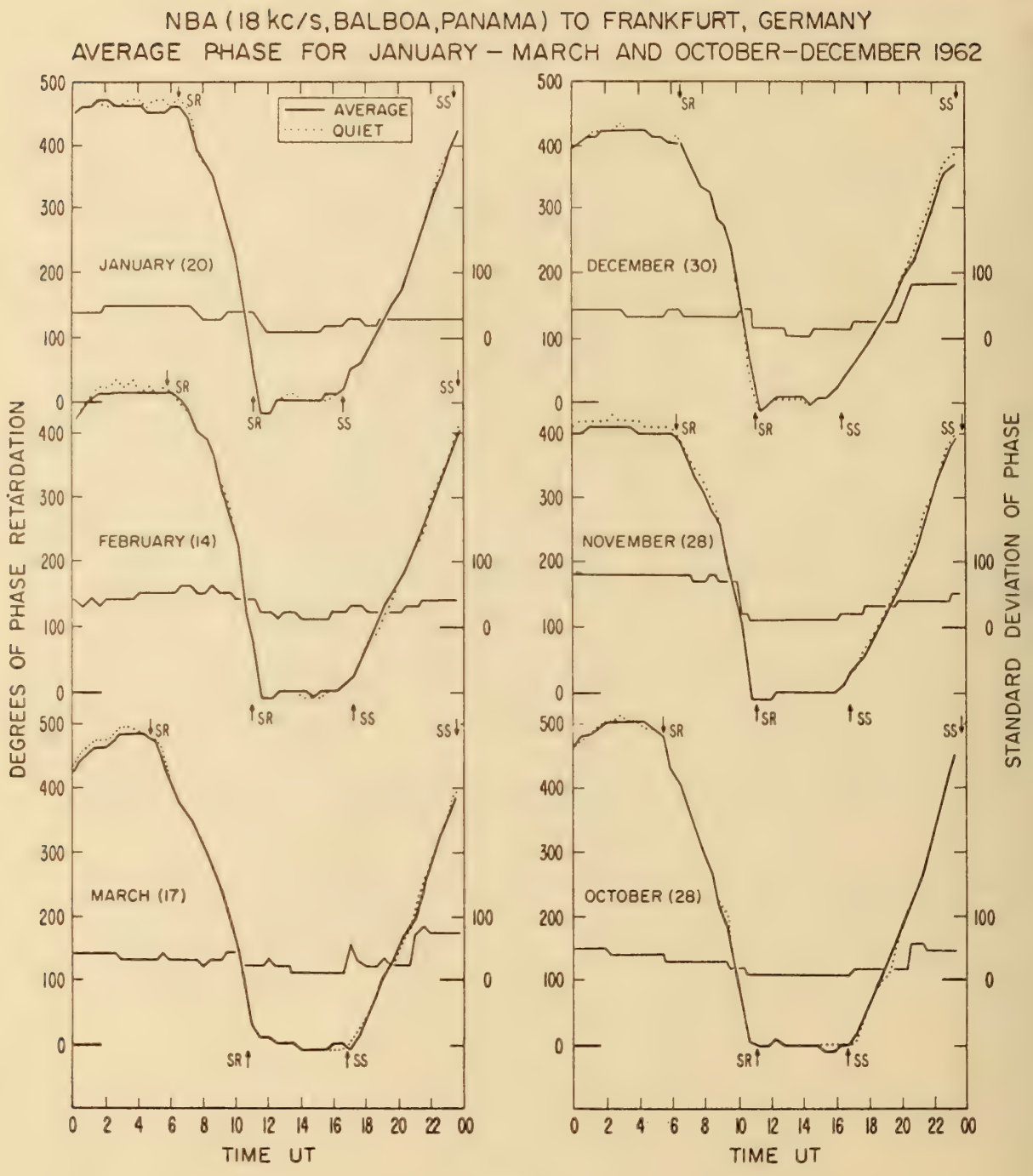
NBA (18 kc/s, BALBOA, PANAMA) TO FRANKFURT, GERMANY
AVERAGE PHASE FOR JANUARY – MARCH AND OCTOBER–DECEMBER 1962
AVERAGE
QUIET
JANUARY (20)
FEBRUARY (14)
MARCH (17)
DECEMBER (30)
NOVEMBER (28)
OCTOBER (28)
SR
SS
DEGREES OF PHASE RETARDATION
STANDARD DEVIATION OF PHASE
TIME UT
0 2 4 6 8 10 12 14 16 18 20 22 00

Figure 2

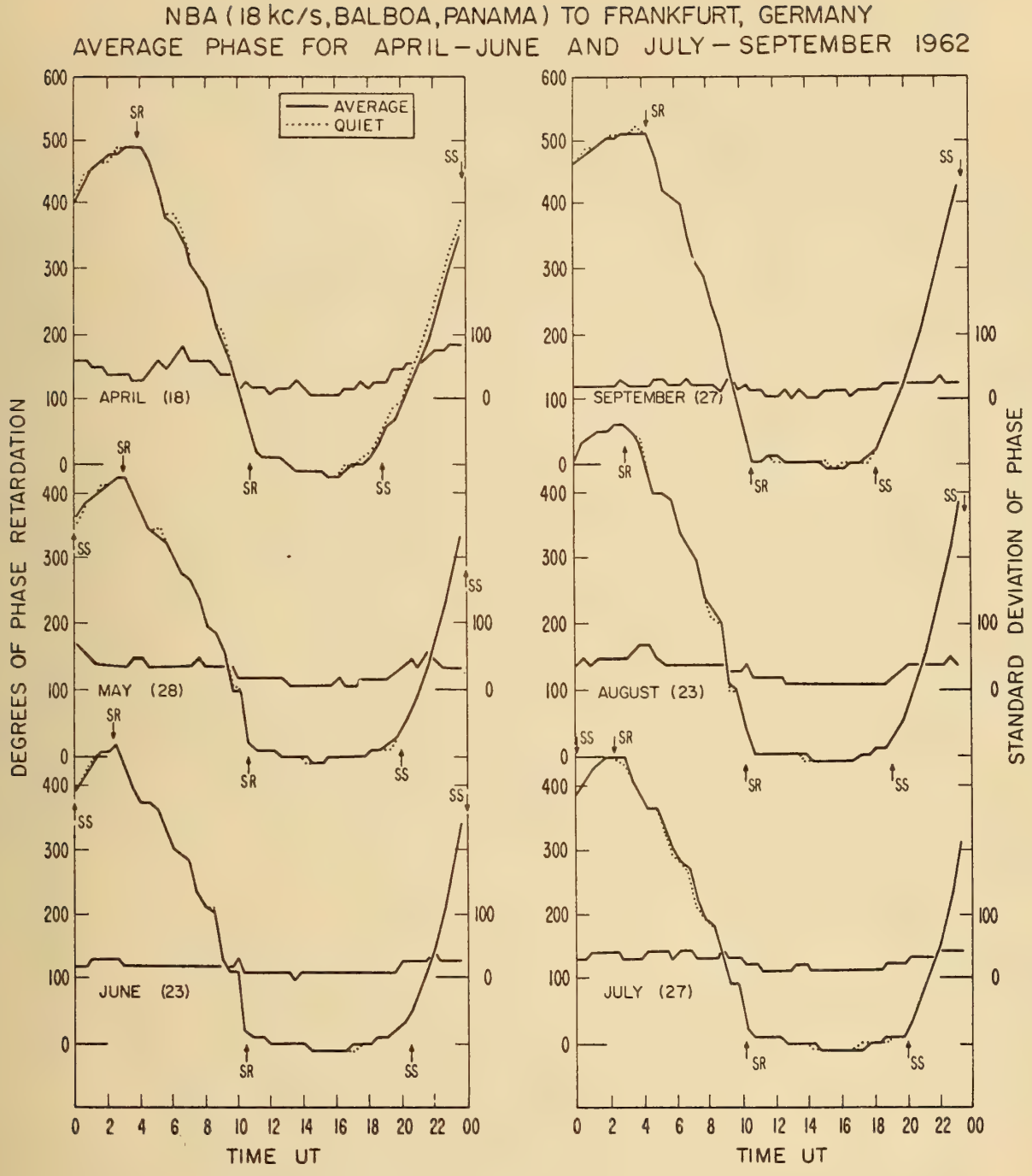
NBA (18 kc/s, BALBOA, PANAMA) TO FRANKFURT, GERMANY
AVERAGE PHASE FOR APRIL – JUNE AND JULY – SEPTEMBER 1962
AVERAGE
QUIET
APRIL (18)
MAY (28)
JUNE (23)
JULY (27)
AUGUST (23)
SEPTEMBER (27)
SR
SS
DEGREES OF PHASE RETARDATION
STANDARD DEVIATION OF PHASE
TIME UT

Figure 3

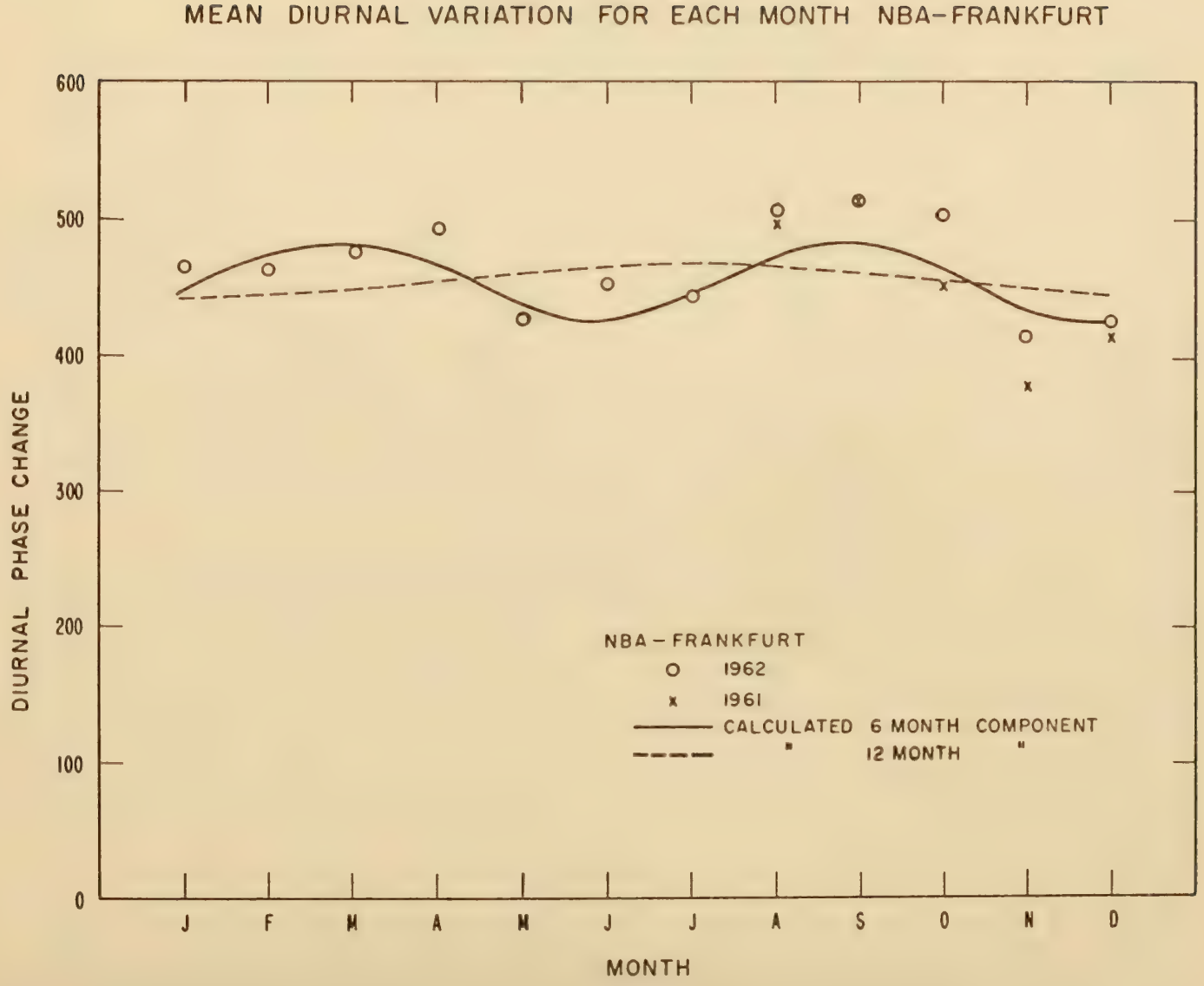
MEAN DIURNAL VARIATION FOR EACH MONTH NBA-FRANKFURT
DIURNAL PHASE CHANGE
600
500
400
300
200
100
0
J
F
M
A
M
J
J
A
S
O
N
D
MONTH
NBA - FRANKFURT
1962
1961
CALCULATED 6 MONTH COMPONENT
" 12 MONTH "

Figure 4

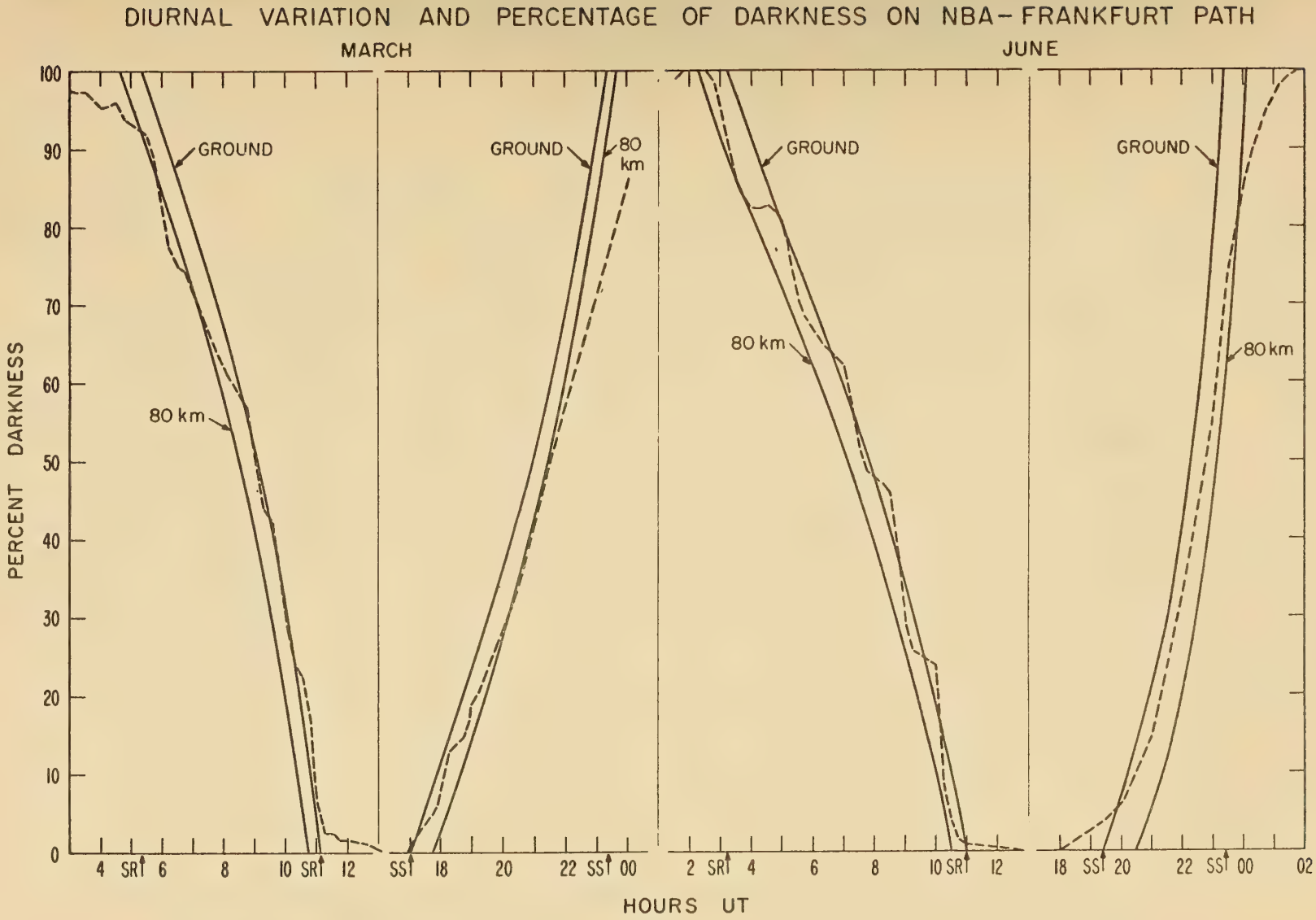
DIURNAL VARIATION AND PERCENTAGE OF DARKNESS ON NBA-FRANKFURT PATH
MARCH
JUNE
PERCENT DARKNESS
HOURS UT
GROUND
80 km
SRT
SST
0
10
20
30
40
50
60
70
80
90
100
4
6
8
10
12
18
20
22
00
2
02

Figure 5

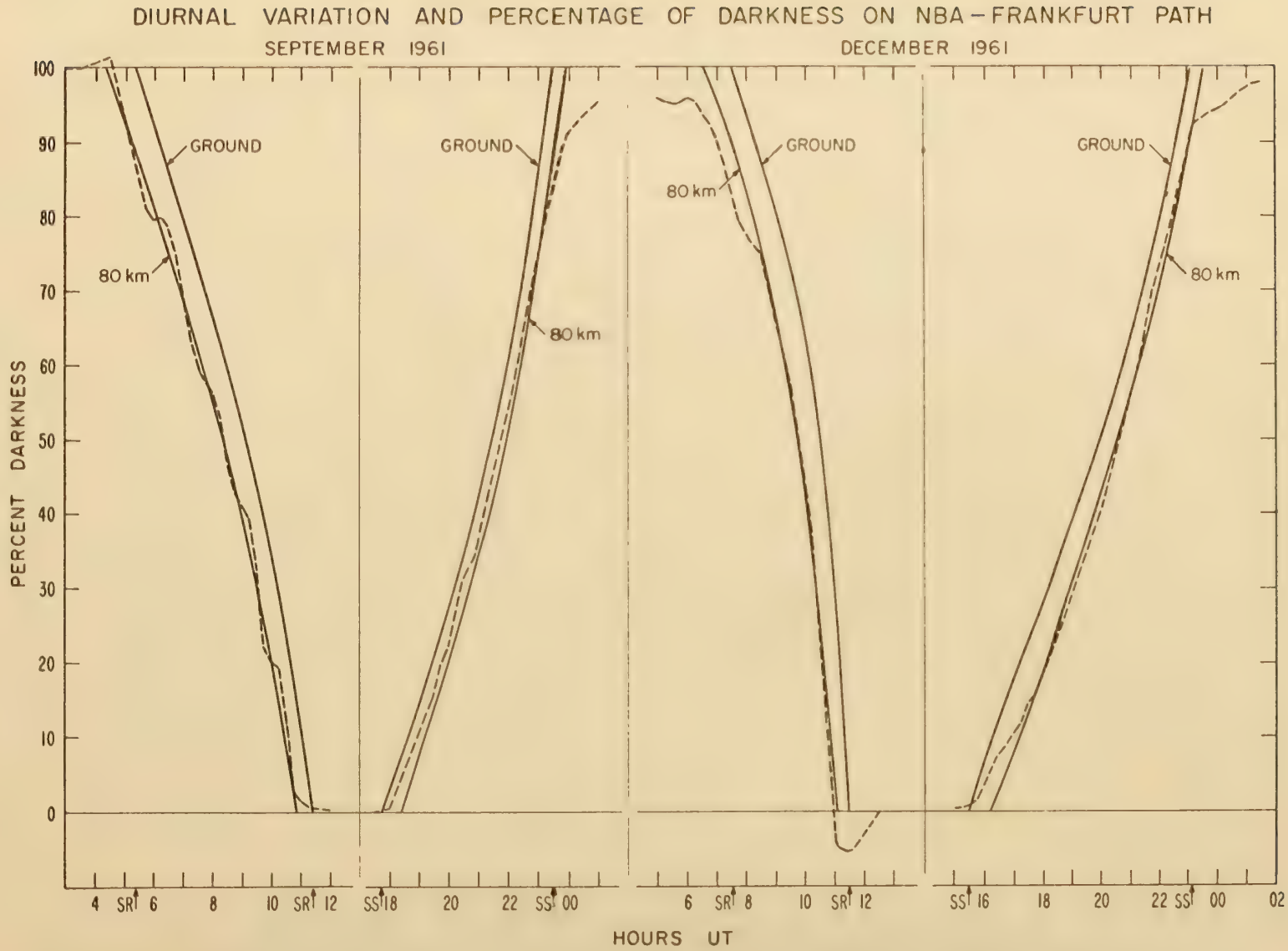
DIURNAL VARIATION AND PERCENTAGE OF DARKNESS ON NBA – FRANKFURT PATH
SEPTEMBER 1961
DECEMBER 1961
PERCENT DARKNESS
HOURS UT
GROUND
80 km
SR
SS

Figure 6

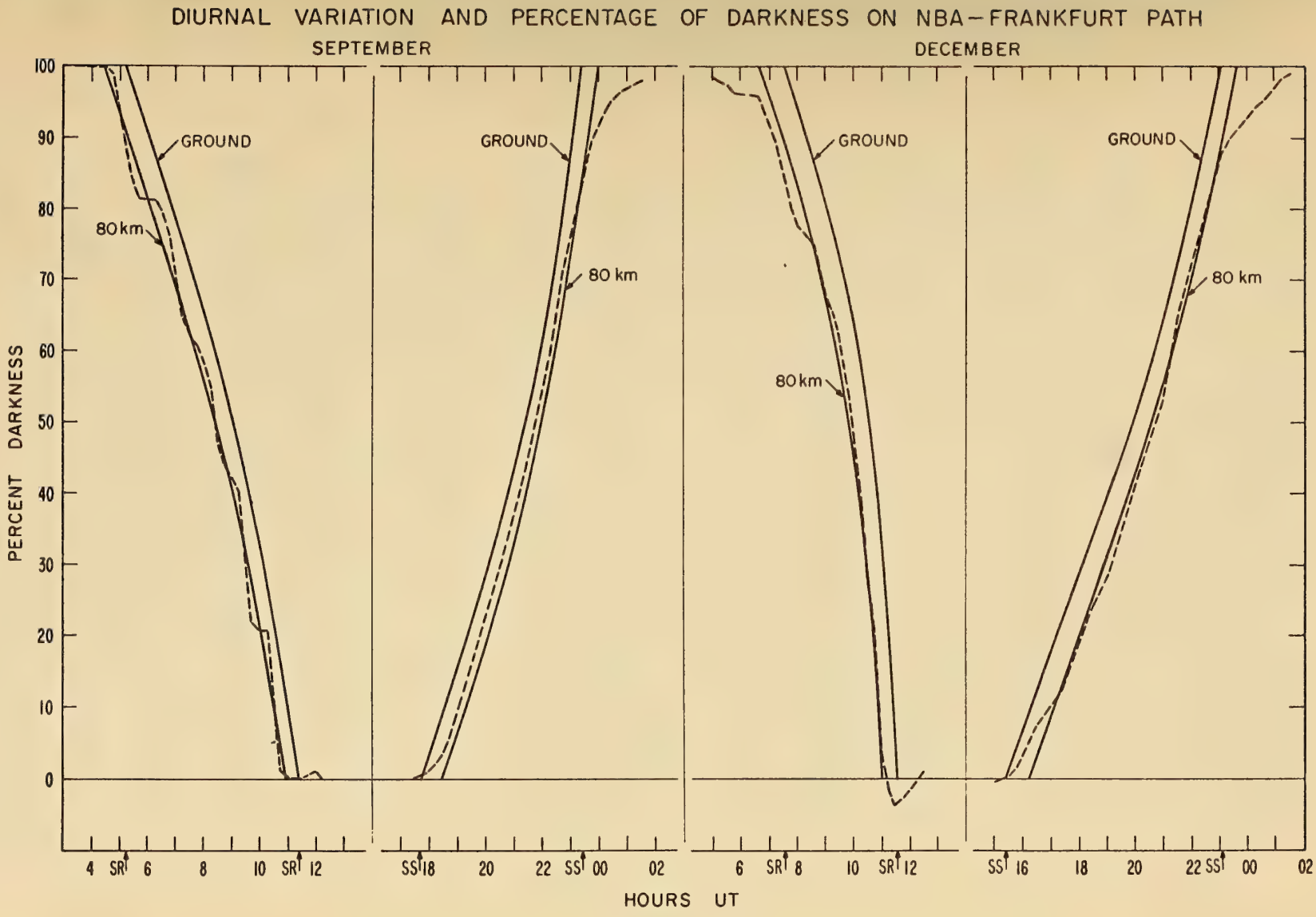
DIURNAL VARIATION AND PERCENTAGE OF DARKNESS ON NBA–FRANKFURT PATH
SEPTEMBER
DECEMBER
PERCENT DARKNESS
100
90
80
70
60
50
40
30
20
10
0
GROUND
80km
80 km
4 SR 6 8 10 SR 12
SS 18 20 22 SS 00 02
6 SR 8 10 SR 12
SS 16 18 20 22 SS 00 02
HOURS UT

Figure 7

MONTHLY AVERAGE ON PATH 2 3 FOR MONTH 1 1962

UT	AVER	SDV NO	QAV NO		+ 5 MIN			+10 MIN			+15 MIN			+20 MIN			+25 MIN	
00	946.	39.20	950.13	948.	40.20	952.13	951.	40.20	956.13	953.	40.20	957.13	956.	40.20	959.13	957.	40.20	961.13
	957.	41.21	963.13	958.	41.21	965.13	960.	42.21	968.13	961.	42.21	968.13	962.	42.21	966.14	964.	42.21	967.14
01	965.	42.21	962.14	966.	43.20	963.13	967.	43.20	964.13	967.	44.20	964.13	967.	44.20	964.13	967.	44.20	967.12
	967.	44.20	968.12	967.	43.20	967.12	967.	43.20	963.13	967.	43.20	966.12	966.	44.20	966.12	966.	45.20	965.12
02	966.	45.20	965.12	962.	44.19	962.13	962.	45.19	963.13	962.	45.19	963.13	962.	45.19	963.13	961.	46.19	962.13
	964.	48.20	961.13	964.	47.20	961.13	963.	47.20	960.13	959.	45.19	960.13	959.	46.19	960.13	958.	46.19	960.13
03	957.	45.20	960.14	957.	45.20	963.15	956.	45.20	963.15	956.	46.20	963.15	956.	46.20	967.14	954.	48.19	966.13
	958.	50.20	966.13	958.	51.20	966.13	958.	51.20	966.13	958.	52.20	966.13	957.	52.20	966.13	958.	52.20	966.13
04	958.	52.20	966.13	958.	53.20	967.13	960.	53.21	974.15	958.	51.21	968.14	955.	51.21	964.14	954.	51.21	963.14
	953.	51.21	965.15	953.	51.21	965.15	952.	51.21	961.14	953.	50.21	964.15	953.	50.21	965.15	953.	50.21	965.15
05	953.	50.21	966.15	953.	50.21	966.15	953.	50.21	967.15	954.	50.21	968.15	955.	50.21	969.15	955.	50.21	969.15
	955.	50.21	967.14	955.	50.21	966.14	955.	50.21	968.15	955.	50.21	968.15	955.	50.21	966.14	955.	50.21	965.14
06	955.	49.21	962.15	955.	49.21	962.15	955.	49.21	967.14	956.	50.21	967.14	956.	50.21	967.14	956.	50.21	968.14
	956.	50.21	970.15	956.	50.21	970.15	955.	50.21	970.15	954.	50.21	969.15	953.	50.21	968.15	949.	49.21	964.15
07	944.	48.21	959.15	940.	46.21	951.14	934.	45.21	945.14	928.	43.21	936.14	921.	42.21	930.14	912.	38.21	922.15
	902.	36.21	910.15	895.	34.21	906.14	888.	32.21	898.14	882.	30.21	891.14	875.	29.21	884.14	871.	29.21	879.14
08	866.	29.21	870.14	864.	30.21	869.14	862.	32.21	867.14	861.	32.21	862.15	859.	33.21	860.15	856.	34.21	858.16
	853.	34.21	853.16	849.	33.21	849.16	844.	32.21	845.16	838.	30.21	839.16	831.	29.21	833.18	822.	28.21	826.19
09	813.	27.21	817.19	806.	28.21	809.19	798.	29.21	802.19	790.	31.21	796.18	781.	40.21	791.18	778.	39.21	788.18
	774.	38.21	783.18	767.	38.21	776.18	760.	38.21	769.18	748.	38.21	756.18	736.	37.21	743.18	724.	36.21	732.18
10	711.	36.21	719.18	706.	37.21	714.18	700.	38.21	708.18	693.	37.21	700.17	686.	37.21	693.17	665.	38.21	673.18
	645.	41.21	652.18	626.	41.21	633.18	606.	41.21	614.18	599.	41.21	606.18	591.	40.21	606.18	586.	38.21	589.18
11	569.	36.21	576.17	546.	24.20	546.17	516.	27.20	516.15	504.	16.19	501.14	486.	18.20	486.15	483.	17.20	483.15
	480.	16.20	481.16	479.	15.20	479.15	479.	14.20	479.14	479.	15.20	480.14	480.	15.20	482.13	481.	14.20	483.13
12	482.	14.20	484.12	485.	12.20	486.12	488.	10.21	487.12	490.	10.21	490.11	492.	9.21	494.12	494.	9.21	496.13
	496.	9.21	498.14	497.	8.21	500.13	500.	8.21	502.15	501.	7.21	502.16	502.	7.21	503.16	503.	7.21	504.18
13	504.	7.21	506.17	505.	8.19	505.17	506.	8.19	506.16	505.	7.18	506.16	505.	7.18	505.15	505.	7.18	506.17
	504.	7.18	506.16	504.	6.18	506.16	504.	6.18	506.17	504.	6.18	505.16	503.	6.18	504.16	503.	7.18	504.16
14	503.	7.18	504.16	503.	7.18	503.16	502.	7.18	503.15	502.	8.18	502.15	501.	8.18	501.15	501.	8.18	501.15
	500.	8.18	501.15	500.	8.18	500.15	499.	8.18	500.14	499.	9.18	500.14	498.	9.18	499.13	498.	9.18	499.14
15	497.	9.18	499.14	501.	8.18	499.15	505.	21.18	500.17	505.	20.18	500.17	505.	20.18	500.17	505.	19.18	500.17
	505.	19.18	501.17	506.	19.18	502.17	507.	19.18	502.17	508.	20.18	503.17	509.	20.18	504.17	510.	21.18	505.17
16	512.	22.18	507.17	512.	22.18	508.17	514.	23.18	509.17	516.	23.18	511.17	518.	23.18	515.16	520.	23.18	517.16
	523.	24.18	519.16	527.	24.18	525.15	531.	24.18	530.15	536.	24.18	534.15	540.	25.18	539.15	544.	25.18	542.16
17	549.	25.18	546.16	552.	25.18	549.16	555.	24.18	552.16	557.	24.18	554.16	560.	24.18	557.16	561.	25.18	559.16
	563.	25.18	561.16	565.	25.18	562.16	567.	25.18	564.16	568.	24.18	565.16	571.	24.18	568.16	573.	23.18	571.16
18	577.	22.18	574.16	580.	23.18	577.16	584.	23.19	581.17	588.	23.19	585.17	592.	24.19	590.17	597.	24.19	594.17
	602.	24.19	599.17	607.	25.19	606.16	612.	27.19	613.16	616.	27.19	615.15	621.	27.19	619.15	624.	27.19	623.15
19	628.	27.19	627.15	631.	28.19	631.16	635.	29.19	633.17	637.	28.19	635.17	641.	28.19	639.17	644.	29.19	642.17
	649.	28.20	647.18	652.	28.20	651.18	656.	28.20	655.18	660.	27.20	659.18	665.	26.20	663.18	670.	26.20	668.18
20	675.	26.20	673.18	680.	26.20	679.18	686.	27.20	687.17	692.	27.20	694.15	699.	27.20	701.15	706.	28.20	705.16
	713.	28.20	712.16	718.	29.20	717.16	723.	29.20	723.16	728.	29.20	728.16	733.	30.20	734.16	737.	30.20	736.16
21	741.	31.20	742.12	746.	30.20	750.13	752.	29.21	755.14	757.	28.21	761.14	764.	28.21	767.14	771.	28.21	774.14
	778.	28.21	780.13	786.	28.21	789.14	794.	28.21	797.14	800.	28.21	799.14	807.	29.21	808.13	813.	30.21	812.12
22	819.	31.21	818.12	825.	32.21	824.12	831.	32.21	831.12	836.	32.21	836.12	841.	32.21	841.12	847.	32.21	851.14
	852.	32.21	857.14	857.	32.21	862.14	863.	32.21	868.14	868.	32.21	870.13	874.	32.21	876.13	879.	33.21	881.13
23	886.	33.21	888.13	893.	33.21	894.13	900.	33.21	901.13	904.	33.21	905.13	910.	33.21	913.14	916.	34.20	923.12
	920.	34.20	924.13	923.	34.20	927.13	926.	34.20	932.14	928.	34.20	934.14	930.	34.20	936.14	933.	34.20	936.14

Table 1

MONTHLY AVERAGE ON PATH 2 3 FOR MONTH 2 1962

UT	AVER	SDV NO	QAV NO		+ 5 MIN			+10 MIN			+15 MIN			+20 MIN			+25 MIN	
00	922.	35.14	915. 9	925.	35.14	917. 9	928.	35.14	920. 9	931.	35.14	923. 9	934.	35.14	930. 8	936.	34.14	937. 9
	939.	33.14	937.10	941.	33.14	943. 9	944.	34.14	951. 8	945.	34.14	953. 8	947.	34.14	956. 8	950.	34.14	959. 8
01	953.	35.14	963. 8	954.	35.14	964. 8	956.	35.14	966. 8	956.	35.14	967. 8	957.	36.14	968. 8	958.	35.14	968. 8
	959.	34.14	969. 8	960.	35.14	970. 8	960.	35.14	971. 8	960.	36.14	972. 8	960.	37.14	975. 9	961.	37.14	972. 8
02	961.	37.14	973. 8	961.	37.14	973. 8	962.	37.14	976. 9	962.	38.14	974. 8	963.	38.14	974. 8	962.	39.14	977. 9
	963.	39.14	977. 9	963.	39.14	977. 9	964.	39.14	978. 9	964.	39.14	978. 9	964.	40.14	979. 9	964.	40.14	978. 9
03	964.	40.14	973.10	965.	41.14	973.10	965.	41.14	974.10	965.	42.14	970. 9	964.	43.14	969. 9	965.	43.14	969. 9
	965.	43.14	975. 8	965.	43.14	975. 8	964.	43.14	975. 8	964.	44.14	979. 9	964.	45.14	969. 9	964.	45.14	964. 8
04	965.	45.14	964. 8	964.	46.14	963. 8	963.	46.14	973. 8	963.	47.14	973. 8	962.	47.14	973. 8	962.	46.14	972. 8
	961.	46.14	971. 8	961.	46.14	965. 9	960.	47.14	965. 9	960.	47.14	959.10	959.	47.14	959.10	958.	47.14	963. 9
05	957.	48.14	962. 9	958.	48.14	963. 9	959.	47.14	958.10	959.	47.14	958.10	959.	47.14	959.10	962.	46.14	963.10
	965.	47.14	967.10	964.	48.14	966.10	963.	48.14	965. 8	962.	48.14	965. 8	962.	48.14	969. 9	960.	50.14	958.11
06	959.	52.14	961.12	958.	52.14	956.11	958.	52.14	956.11	956.	54.14	955.11	954.	55.14	953.11	952.	56.14	951.11
	949.	58.14	942.10	947.	58.14	939.10	944.	59.14	937.10	942.	60.14	934.10	940.	60.14	932.10	934.	60.14	932.11
07	928.	60.14	926.11	922.	59.14	925.10	916.	58.14	919.10	912.	56.14	914.10	908.	54.14	904.11	904.	52.14	899.11
	899.	50.14	899.10	896.	49.14	892.11	893.	49.14	888.11	892.	49.14	887.11	890.	49.14	885.11	889.	49.14	884.11
08	887.	51.14	887.12	885.	53.14	886.12	883.	55.14	885.12	878.	58.14	881.12	873.	61.14	877.12	867.	61.14	866.11
	860.	61.14	860.11	853.	58.14	854.11	845.	56.14	846.11	838.	54.14	839.11	830.	53.14	835.12	821.	49.14	827.12
09	813.	45.14	819.12	803.	45.13	811.11	798.	47.13	806.11	791.	49.13	800.11	783.	51.13	792.11	774.	50.13	787.12
	765.	50.13	778.12	756.	48.13	765.11	747.	46.13	755.11	740.	45.12	751.11	731.	42.12	742.11	723.	42.12	734.11
10	716.	41.12	723.10	708.	45.11	720.10	700.	50.11	708. 9	688.	52.11	692. 8	665.	60.12	678. 8	642.	48.12	656. 9
	618.	42.12	627. 9	612.	37.12	625.10	606.	33.12	618.10	601.	34.12	611. 9	595.	36.12	602. 8	581.	36.11	578. 6
11	565.	39.11	552. 7	540.	30.11	528. 7	512.	33.12	512. 8	504.	27.12	504. 8	493.	25.13	494. 7	491.	22.13	488. 6
	488.	20.14	486. 8	486.	18.14	486. 8	485.	17.14	486. 9	485.	16.14	486. 9	485.	16.14	487. 9	486.	16.14	488. 9
12	488.	16.14	490. 9	491.	14.14	491. 8	494.	13.14	494.10	495.	13.14	496. 9	497.	13.14	497.10	498.	12.14	499. 9
	499.	13.14	499.10	499.	13.14	499.10	499.	14.14	500.10	499.	14.14	501.10	499.	15.14	502.10	499.	16.14	507.10
13	499.	17.14	502.10	499.	17.13	501. 9	498.	17.13	498.10	498.	17.13	498.10	498.	17.13	498.10	497.	17.13	498.10
	497.	17.13	497.10	496.	16.13	497.10	496.	16.13	496.10	496.	15.13	494. 9	496.	14.13	491. 8	495.	14.13	491. 8
14	495.	12.14	491. 9	496.	12.14	492. 9	496.	11.14	492. 9	496.	10.14	492. 9	495.	10.14	493.10	495.	9.14	494.11
	495.	9.14	494.10	495.	8.14	496. 8	495.	8.14	495. 9	494.	7.14	494. 9	494.	7.14	494. 9	495.	7.14	494.10
15	495.	7.14	494. 8	497.	7.14	498. 8	499.	9.14	497.10	499.	9.14	499. 9	500.	10.14	499.10	500.	10.14	498.11
	499.	13.14	498.11	498.	17.14	499.11	498.	20.14	500.11	498.	23.14	500.11	498.	24.14	502.12	498.	22.14	502.12
16	498.	22.14	503.11	501.	19.14	503.12	504.	18.14	505.12	507.	17.14	507.12	510.	17.14	509.12	512.	16.14	509.11
	514.	17.14	512. 8	516.	17.14	517. 9	515.	20.14	514.10	516.	23.14	514.11	520.	21.14	519.10	522.	22.14	522.10
17	523.	30.14	522.11	528.	30.14	530.10	536.	28.14	536.10	540.	28.14	540.10	545.	26.14	545.10	549.	26.14	551. 9
	553.	25.14	555. 9	556.	26.14	556.10	560.	25.14	561.10	563.	24.14	564.10	568.	24.14	569.10	571.	23.14	573.10
18	575.	24.14	577.10	578.	24.14	581.10	581.	24.14	584.10	585.	24.14	587.10	587.	24.14	586. 9	591.	25.14	589. 9
	596.	24.14	594. 9	600.	23.14	598. 9	605.	22.14	603. 9	610.	23.14	607. 9	615.	24.14	613. 9	620.	22.14	618. 9
19	625.	21.14	620. 8	631.	20.14	624. 9	638.	21.14	631. 9	642.	21.14	635. 9	646.	21.14	639. 9	649.	22.14	646.10
	652.	24.14	652.11	655.	25.13	657.11	658.	24.13	660.11	661.	23.13	661.10	665.	23.13	663.10	668.	22.13	667.10
20	672.	22.13	673. 9	678.	23.13	676.10	684.	23.13	680. 9	688.	24.13	684. 9	693.	26.13	692.10	699.	26.13	698.10
	704.	28.13	701. 9	709.	28.13	709. 8	715.	29.13	721. 8	719.	30.13	726. 8	721.	31.14	723. 8	725.	31.14	723. 9
21	729.	32.14	727. 9	733.	33.14	736.10	738.	34.14	742.10	743.	36.14	747.10	749.	38.14	752.10	754.	38.14	758.10
	760.	37.14	764.10	766.	38.14	771.10	773.	39.14	779.10	780.	39.14	786.10	788.	39.14	789. 9	794.	39.14	800.10
22	801.	39.14	806.10	807.	38.14	818. 9	815.	37.14	825. 9	819.	37.14	828. 9	823.	37.14	833. 9	829.	37.14	837. 9
	835.	36.14	842. 9	839.	35.14	846. 9	844.	35.14	851. 9	848.	35.14	855. 9	853.	35.14	860. 9	858.	35.14	865. 9
23	863.	35.14	870. 9	870.	35.14	877. 9	878.	36.14	884. 9	882.	37.14	889. 9	887.	37.14	899. 8	893.	37.14	905. 8
	899.	38.14	912. 8	905.	36.14	920. 9	912.	35.14	920. 9	915.	36.14	923. 9	919.	37.14	927. 9	923.	38.14	931. 9

Table 2

MONTHLY AVERAGE ON PATH 2 3 FOR MONTH 3 1962

UT	AVER	SDV NO	QAV NO		+ 5 MIN			+10 MIN			+15 MIN			+20 MIN			+25 MIN	
00	915.	41.15	929.13	920.	42.15	934.13	925.	42.15	939.13	928.	41.15	942.13	932.	41.15	946.13	935.	41.15	948.13
	938.	40.15	951.13	942.	41.14	956.12	944.	41.14	956.11	946.	40.14	958.11	949.	40.14	960.11	951.	39.14	962.11
01	953.	39.14	964.11	955.	38.14	965.11	957.	38.14	967.11	958.	37.14	968.11	960.	37.14	969.11	961.	36.14	970.11
	962.	36.14	971.11	963.	36.14	972.11	964.	36.14	973.11	965.	37.14	974.11	962.	38.15	975.11	963.	38.15	973.10
02	963.	39.15	974.10	964.	39.15	971. 9	964.	39.15	972. 9	965.	39.15	972. 9	966.	38.15	973. 9	970.	36.14	978. 8
	971.	35.14	978. 8	977.	28.13	982. 9	977.	28.13	985.10	978.	28.13	985.10	978.	29.13	986.10	979.	29.13	987.10
03	980.	29.13	987.10	979.	29.13	989.11	978.	29.13	986.10	978.	29.13	986.10	975.	31.14	986.10	975.	30.14	987.10
	975.	30.14	987.10	976.	30.14	989.11	974.	29.15	986. 9	974.	29.15	982.10	974.	29.15	975. 8	975.	28.15	976. 8
04	975.	28.15	976. 8	975.	29.15	973. 9	975.	30.15	979.11	975.	29.15	977.10	975.	29.15	977.10	976.	29.15	977.10
	976.	29.15	980.11	976.	28.15	979.11	976.	27.15	976.10	973.	26.15	974.10	971.	26.15	975.11	969.	26.15	973.11
05	967.	26.15	971.11	964.	27.15	968.11	961.	29.15	968.10	958.	32.15	968. 8	955.	35.15	966. 8	951.	39.15	958. 9
	948.	43.15	956. 9	943.	43.15	951. 9	937.	43.15	948.10	933.	41.15	943.10	927.	39.15	933. 9	920.	36.15	924.11
06	912.	33.15	914.11	906.	31.15	907.11	900.	30.15	898. 9	894.	29.15	889.10	889.	28.15	883.10	884.	26.15	879.10
	879.	26.15	875.10	875.	26.15	875.11	870.	26.15	872.11	867.	27.15	871.12	864.	27.15	868.12	861.	27.15	865.12
07	858.	27.15	862.12	855.	23.15	855.10	851.	21.15	847. 9	848.	22.15	845. 8	846.	25.15	841. 8	842.	27.15	833.10
	837.	29.15	833.11	833.	28.15	830.10	828.	26.16	826.11	825.	25.16	822.11	822.	23.16	816.12	818.	22.16	814.11
08	813.	20.16	810.11	808.	20.16	807.11	802.	21.16	805.12	799.	21.16	804.13	797.	23.16	803.11	791.	24.15	793.10
	788.	25.15	794.10	782.	29.15	792.11	776.	33.15	792.10	772.	33.15	785. 9	767.	33.15	780. 9	761.	31.15	770. 8
09	754.	30.15	757. 7	741.	28.14	741.10	725.	31.15	727.10	720.	32.15	723.10	715.	33.15	718.10	711.	35.15	714.10
	706.	39.15	710.10	702.	43.15	706.10	702.	50.16	706.11	686.	45.15	690. 9	678.	50.15	681. 9	670.	43.14	672.10
10	656.	43.14	652.11	640.	32.14	640.12	622.	24.15	621.13	618.	20.15	617.12	615.	18.15	614.12	613.	20.15	615.11
	611.	22.15	614.11	602.	27.15	607.11	593.	36.15	599.11	585.	38.15	585.10	577.	42.15	574.10	555.	29.15	555.10
11	533.	20.15	532.10	525.	17.15	529.12	516.	16.15	517.10	515.	16.15	513.11	513.	16.15	511.11	512.	16.15	511.10
	510.	15.15	511.11	510.	15.15	511.11	509.	15.15	509.10	509.	15.15	508.10	503.	25.16	507.12	503.	25.16	508.13
12	505.	25.17	508.13	505.	24.17	507.13	504.	24.17	509.12	504.	24.17	508.12	504.	24.17	508.12	503.	24.17	507.12
	503.	24.17	507.12	503.	23.17	507.12	503.	23.17	507.12	503.	23.17	506.12	502.	23.17	503.13	502.	23.17	503.13
13	501.	22.17	502.13	502.	13.14	503.11	500.	12.14	499.11	499.	12.14	497.12	498.	12.14	497.11	497.	11.14	497.11
	496.	10.14	495.12	496.	10.14	494.12	495.	9.14	493.12	494.	8.14	493.12	493.	8.14	493.11	493.	8.14	492.12
14	492.	7.14	491.12	491.	7.14	490.12	490.	8.14	489.11	490.	8.14	489.12	490.	7.14	488.11	489.	7.14	488.10
	489.	7.14	487.11	488.	7.14	486.11	487.	7.14	486.10	488.	8.14	487.10	490.	12.15	487.10	490.	11.15	489.11
15	491.	12.15	490.10	490.	12.15	489.10	488.	12.15	487.11	489.	12.15	487.12	489.	12.15	487.12	489.	12.15	488.13
	490.	12.15	490.12	490.	12.15	489.11	491.	12.15	490.11	492.	12.15	491.11	493.	12.15	492.11	494.	12.15	492.12
16	495.	13.15	494.11	495.	14.14	491. 9	496.	15.14	490.10	497.	16.14	491.10	498.	16.14	491.10	499.	16.14	492.10
	500.	14.14	494.10	501.	14.14	496. 9	490.	37.14	497.12	487.	50.14	501.13	487.	55.14	502.13	489.	52.14	503.13
17	491.	49.14	504.13	494.	45.14	506.13	498.	40.14	509.13	501.	38.14	511.13	504.	35.14	511.12	508.	32.14	514.12
	513.	28.14	518.12	517.	24.14	519.11	523.	19.14	520.10	527.	18.14	523.10	532.	18.14	528. 9	536.	19.14	536. 8
18	542.	20.14	542. 8	549.	20.13	555. 7	555.	23.13	563. 8	559.	23.13	565. 7	563.	23.13	565. 6	568.	22.13	568. 6
	572.	21.13	567. 8	575.	19.13	566. 8	579.	18.13	570. 8	582.	17.13	573. 8	594.	35.14	585.13	596.	32.14	588.13
19	599.	29.14	594.12	601.	27.14	597.12	604.	25.14	600.12	607.	23.14	604.12	610.	22.15	607.13	613.	21.15	614.12
	617.	20.15	616.11	622.	19.15	622.11	627.	18.15	624.11	631.	18.15	629.11	636.	19.15	634.11	641.	19.15	640.10
20	645.	20.15	644.10	650.	19.15	650.11	655.	18.15	655.11	660.	16.15	658.12	667.	16.15	664.12	670.	15.14	666.11
	675.	15.14	672.10	679.	15.14	677.10	685.	17.14	687.10	689.	17.14	689. 9	675.	73.15	694.14	682.	73.15	701.14
21	689.	73.15	708.14	696.	73.15	715.14	704.	72.15	723.14	710.	72.15	728.14	724.	76.16	734.14	729.	76.16	740.14
	734.	75.16	745.14	739.	74.16	751.14	744.	72.16	756.14	749.	71.16	761.14	755.	69.16	767.14	760.	69.16	773.14
22	767.	69.16	784.15	773.	68.16	789.15	779.	67.16	795.15	786.	66.16	802.15	793.	65.16	809.15	800.	66.16	816.15
	808.	66.16	824.15	813.	66.16	829.15	818.	66.16	834.15	823.	66.16	839.15	827.	66.16	843.15	833.	66.16	849.15
23	838.	67.16	854.15	845.	67.16	858.14	853.	67.16	865.14	858.	67.16	870.14	863.	67.16	876.14	871.	67.16	883.14
	879.	66.16	891.14	886.	65.16	897.14	893.	64.16	904.14	899.	64.16	909.14	905.	63.16	916.14	911.	63.16	922.14

Table 3

MONTHLY AVERAGE ON PATH 2 3 FOR MONTH 4 1962

UT	AVER	SDV NO	QAV NO		+ 5 MIN			+10 MIN			+15 MIN			+20 MIN			+25 MIN	
00	914.	63.18	923.14	919.	63.18	929.14	925.	62.18	935.14	929.	61.18	937.14	933.	60.18	941.14	936.	58.18	943.14
	939.	57.18	946.14	942.	55.18	949.14	946.	54.18	952.14	948.	53.18	955.14	951.	52.18	957.14	953.	52.18	960.14
01	956.	51.18	962.14	959.	49.18	965.14	963.	48.18	964.13	965.	47.18	966.13	967.	46.18	968.13	969.	45.18	966.12
	971.	45.18	968.12	972.	45.18	970.12	973.	45.18	971.12	973.	45.18	972.12	974.	45.18	973.12	975.	44.18	973.12
02	976.	43.18	974.12	978.	42.18	976.12	979.	42.18	977.12	980.	41.18	984.14	980.	40.18	984.14	981.	39.18	985.14
	982.	38.18	986.14	983.	38.18	987.14	984.	38.18	988.14	985.	37.18	989.14	986.	37.18	987.15	987.	37.18	988.15
03	988.	37.18	989.15	988.	36.18	990.15	988.	35.18	990.15	989.	35.18	991.15	989.	34.18	991.15	990.	34.18	989.14
	990.	34.18	990.14	991.	34.18	993.15	991.	33.18	993.15	991.	33.18	993.15	992.	33.18	993.15	991.	33.18	993.15
04	991.	34.18	992.15	989.	36.18	990.15	987.	39.18	989.15	985.	43.18	986.15	983.	47.18	983.15	976.	49.18	977.15
	969.	51.18	971.15	962.	53.18	965.15	954.	56.18	961.16	945.	58.18	952.16	935.	60.18	943.16	927.	59.18	939.15
05	918.	59.18	930.15	909.	55.18	921.15	900.	52.18	915.16	893.	50.18	904.17	887.	47.18	897.17	884.	47.18	894.17
	880.	47.18	891.17	878.	48.18	889.17	877.	50.18	888.17	877.	50.18	888.17	877.	51.18	888.17	877.	52.18	886.16
06	869.	65.19	887.16	868.	68.19	886.16	866.	71.19	885.16	863.	72.19	882.16	859.	74.19	879.16	855.	75.19	874.16
	850.	76.19	869.16	845.	75.19	869.15	839.	75.19	863.15	831.	72.19	851.14	823.	70.19	831.14	816.	66.19	827.15
07	808.	64.19	818.15	802.	61.19	812.15	795.	59.19	805.15	793.	58.19	803.15	790.	56.19	800.15	788.	56.19	798.15
	786.	56.19	796.15	784.	55.19	794.15	782.	56.19	795.16	780.	56.19	793.16	777.	56.19	790.16	772.	57.19	785.16
08	766.	57.19	784.15	757.	57.19	771.14	748.	58.19	761.14	740.	56.19	751.14	731.	54.19	737.15	725.	51.19	727.14
	718.	48.19	725.13	712.	45.19	720.13	706.	42.19	717.14	704.	41.19	715.14	701.	40.19	713.15	698.	40.19	707.16
09	694.	41.19	710.16	689.	41.19	700.14	684.	41.19	693.14	677.	41.19	685.12	669.	42.19	676.12	659.	41.19	667.11
	648.	41.19	650.12	634.	29.19	637.12	619.	21.19	619.13	614.	19.19	614.13	609.	18.19	609.13	607.	18.19	610.12
10	606.	18.19	605.12	605.	18.19	606.13	604.	18.19	605.13	601.	19.19	603.12	598.	21.19	596.12	583.	24.19	581.12
	567.	31.19	557.13	553.	23.19	549.11	538.	19.19	534.12	533.	18.19	531.11	528.	18.19	526.14	525.	18.19	521.16
11	520.	18.20	516.17	518.	18.20	514.17	516.	18.20	511.18	515.	17.20	510.18	514.	16.20	510.18	514.	15.20	510.18
	514.	15.20	510.17	513.	15.20	510.18	513.	15.20	509.18	513.	15.20	509.18	513.	15.20	510.17	513.	15.20	510.17
12	512.	14.20	509.18	511.	14.20	508.17	509.	15.20	508.18	508.	16.20	506.17	508.	16.20	506.17	507.	15.20	507.18
	507.	15.20	506.18	506.	15.20	505.18	504.	15.20	503.18	502.	17.20	503.17	500.	20.20	502.17	499.	18.20	501.17
13	498.	16.20	500.16	498.	13.17	497.14	494.	17.17	496.13	492.	26.17	495.15	490.	33.17	496.15	491.	30.17	495.15
	489.	27.17	493.15	490.	24.17	493.15	490.	21.17	493.15	491.	20.17	493.15	491.	18.17	493.15	492.	16.17	493.15
14	492.	15.17	491.14	491.	15.17	491.13	490.	15.17	491.13	490.	15.17	491.13	490.	14.17	490.13	490.	14.17	490.13
	490.	14.17	490.12	490.	11.17	490.12	490.	9.17	491.10	490.	8.17	491.10	488.	8.17	489.12	489.	8.17	490.12
15	489.	8.17	490.14	486.	6.16	486.12	483.	8.16	484.12	484.	8.16	484.12	484.	8.16	483.11	484.	9.16	484.11
	484.	9.16	484.13	484.	9.16	483.13	484.	9.16	483.13	484.	9.16	483.13	484.	10.16	483.13	484.	10.16	483.13
16	485.	11.16	484.13	485.	12.16	485.13	487.	15.16	489.12	488.	15.16	491.12	490.	16.16	492.12	491.	16.16	494.12
	493.	16.16	497.13	495.	17.16	499.13	497.	18.16	500.12	498.	18.16	501.12	500.	18.16	501.13	501.	19.16	502.13
17	503.	19.16	504.13	504.	19.16	506.13	505.	20.16	507.13	505.	21.16	507.13	502.	25.16	509.13	502.	25.16	510.14
	503.	26.16	514.13	505.	25.16	515.13	506.	24.16	515.12	508.	24.16	516.12	510.	23.16	514.14	512.	23.16	516.14
18	515.	24.16	516.13	518.	24.16	520.13	521.	25.16	525.14	523.	25.16	529.15	525.	26.16	531.15	528.	26.16	534.15
	531.	27.16	535.14	533.	26.16	538.14	537.	26.16	541.14	541.	26.16	545.14	546.	27.16	550.14	551.	28.16	553.13
19	557.	29.16	559.13	562.	29.16	566.14	567.	30.16	572.14	567.	34.16	572.14	568.	42.16	580.13	571.	44.16	586.14
	575.	46.16	587.13	577.	46.16	590.13	580.	47.16	592.13	582.	48.16	595.13	585.	48.16	593.14	590.	50.16	598.14
20	596.	52.16	604.14	601.	54.16	614.13	606.	56.16	621.13	611.	57.16	627.13	617.	59.16	636.14	623.	60.16	642.14
	626.	61.17	641.14	631.	62.17	650.15	638.	61.18	656.16	643.	62.18	661.16	648.	63.18	667.16	651.	63.18	671.16
21	657.	63.19	676.17	661.	63.19	680.17	666.	64.19	685.17	671.	65.19	690.17	677.	67.19	697.17	683.	68.19	703.17
	690.	70.19	710.17	698.	73.18	721.16	706.	76.18	729.16	713.	76.18	736.16	720.	77.18	744.16	726.	77.18	750.16
22	733.	77.18	757.16	739.	77.18	764.16	746.	77.18	771.16	751.	78.18	777.16	757.	79.18	783.16	763.	80.18	789.16
	770.	80.18	796.16	777.	82.18	804.16	786.	83.18	813.16	792.	84.18	820.16	800.	85.18	828.16	806.	85.18	834.16
23	813.	85.18	841.16	819.	86.18	848.16	826.	87.18	855.16	832.	88.18	861.16	839.	89.18	869.16	846.	90.18	876.16
	854.	92.18	884.16	861.	92.18	891.16	868.	93.18	899.16	876.	92.18	906.16	884.	92.18	914.16	893.	92.18	922.16

Table 4

MONTHLY AVERAGE ON PATH 2 3 FOR MONTH 5 1962

UT	AVER	SDV NO	QAV NO		+ 5 MIN			+10 MIN			+15 MIN			+20 MIN			+25 MIN	
00	866.	67.26	863.22	870.	65.26	867.22	875.	63.26	872.22	878.	61.26	876.22	882.	59.26	880.22	884.	58.26	883.22
	887.	56.26	885.22	890.	54.26	886.21	893.	53.26	890.21	895.	52.26	892.21	897.	51.26	895.21	899.	50.26	898.21
01	902.	50.26	901.21	904.	48.26	903.21	906.	47.26	906.21	908.	47.26	908.21	911.	46.26	911.21	913.	45.26	913.21
	914.	44.26	915.21	916.	44.26	917.21	918.	43.26	919.21	919.	42.26	919.20	920.	42.26	922.21	921.	41.26	923.21
02	923.	41.26	924.21	923.	40.26	925.21	925.	40.26	930.21	925.	39.26	927.21	926.	39.26	928.21	927.	39.26	930.22
	928.	39.26	930.21	929.	39.26	932.22	929.	39.26	933.22	928.	39.26	932.22	928.	40.26	931.22	927.	41.26	929.21
03	926.	43.26	928.21	923.	44.26	926.21	921.	46.26	923.21	917.	47.26	914.19	913.	48.26	910.19	909.	50.26	906.20
	903.	52.26	899.20	898.	51.26	894.20	891.	49.26	889.20	885.	50.26	883.20	879.	50.26	877.20	874.	49.26	875.21
04	869.	48.26	870.21	864.	47.26	866.21	859.	47.26	860.20	856.	45.26	859.21	853.	43.26	854.20	851.	42.26	854.19
	849.	41.26	852.19	847.	41.26	850.19	846.	41.26	849.19	844.	40.26	847.19	843.	39.26	848.20	842.	39.26	847.20
05	841.	39.26	846.20	839.	39.26	844.20	836.	40.26	839.21	835.	40.26	838.21	833.	40.26	838.20	830.	40.26	833.21
	827.	41.26	830.21	823.	42.26	828.22	819.	42.26	826.21	813.	43.25	818.21	807.	44.25	810.20	802.	44.25	803.21
06	797.	44.25	800.20	792.	43.25	795.22	786.	43.25	789.20	783.	42.25	783.21	779.	42.25	779.21	777.	42.25	777.21
	776.	41.26	778.21	774.	41.26	779.20	773.	41.26	778.20	772.	41.26	778.21	770.	41.26	777.21	769.	41.26	773.22
07	767.	41.26	770.21	764.	43.26	770.23	762.	46.27	767.23	758.	47.27	762.23	753.	47.27	755.22	747.	47.27	749.22
	741.	48.27	742.22	734.	47.27	735.22	728.	47.28	731.22	722.	45.28	723.21	714.	44.28	716.21	709.	43.28	709.20
08	704.	41.28	704.20	702.	41.28	701.20	701.	40.29	699.20	697.	39.29	697.21	694.	39.29	695.20	693.	39.29	695.20
	692.	39.29	695.20	692.	40.28	694.19	690.	41.28	690.20	687.	41.28	688.19	684.	42.28	684.19	674.	41.28	673.20
09	663.	41.28	663.19	644.	36.28	645.21	624.	35.28	623.22	617.	33.28	620.23	609.	34.28	610.24	605.	34.28	608.24
	600.	35.29	606.25	600.	34.29	606.25	600.	33.29	605.25	601.	34.28	606.24	602.	34.28	606.23	604.	22.27	608.20
10	600.	21.27	601.17	588.	23.27	589.19	575.	29.27	576.19	556.	24.26	555.16	537.	25.27	533.20	529.	19.27	526.19
	521.	19.27	520.19	518.	18.27	514.18	514.	17.28	512.19	513.	16.28	511.18	511.	16.28	509.18	510.	16.28	509.18
11	509.	16.28	509.19	509.	15.28	508.18	508.	15.28	509.21	508.	15.28	509.18	508.	15.28	509.18	508.	15.28	508.19
	508.	15.28	507.19	507.	16.28	507.21	507.	17.28	508.21	507.	17.28	507.22	507.	18.28	507.22	506.	18.28	507.21
12	505.	18.28	508.22	505.	18.28	507.22	505.	17.28	507.22	505.	17.28	506.22	504.	16.28	505.23	504.	16.28	504.23
	503.	15.28	503.21	503.	15.28	503.22	502.	15.28	502.22	502.	14.28	501.22	501.	13.28	501.21	499.	13.28	499.20
13	498.	13.29	499.19	498.	13.24	499.17	498.	13.24	500.18	497.	13.24	499.18	496.	13.24	498.18	497.	12.23	498.17
	497.	11.23	497.17	496.	11.23	496.16	495.	11.23	494.14	495.	10.23	494.14	495.	10.23	495.15	495.	9.23	496.15
14	495.	9.23	495.16	495.	8.23	494.17	494.	8.23	493.17	494.	8.23	493.17	493.	8.23	492.17	493.	9.23	491.18
	492.	9.23	491.18	492.	9.23	491.18	492.	9.24	491.18	491.	9.24	491.18	491.	9.24	491.19	491.	9.24	491.19
15	491.	9.24	491.19	492.	9.24	492.21	494.	10.24	494.20	494.	11.24	495.20	495.	12.24	495.21	495.	12.24	495.21
	495.	13.24	495.21	496.	13.24	495.20	496.	14.24	495.19	496.	14.24	495.19	496.	14.24	495.19	496.	14.24	495.20
16	496.	15.24	495.20	494.	10.23	494.18	494.	10.23	492.15	495.	10.23	495.18	496.	11.23	495.16	496.	11.22	496.15
	497.	12.22	496.16	496.	13.22	497.16	496.	15.22	497.16	496.	15.22	497.16	497.	15.22	497.16	498.	14.22	496.16
17	499.	13.22	499.16	500.	14.22	500.16	501.	14.22	500.15	502.	14.21	502.15	503.	14.21	502.15	501.	14.19	500.13
	502.	15.19	501.13	503.	14.19	501.13	505.	14.19	504.12	505.	15.19	504.12	505.	16.19	502.14	506.	16.19	503.14
18	508.	16.20	506.15	509.	17.20	508.14	511.	17.20	508.13	511.	18.20	508.14	513.	18.21	511.16	513.	19.19	511.14
	512.	20.20	512.14	513.	20.20	511.13	513.	20.20	513.12	514.	21.20	513.12	515.	21.20	514.12	516.	22.20	515.12
19	518.	23.20	512.10	520.	23.20	515.12	522.	23.21	517.13	524.	24.21	517.12	525.	24.21	518.13	528.	25.21	523.12
	532.	25.22	530.14	536.	26.22	534.14	541.	28.22	541.15	545.	30.22	545.15	550.	31.22	547.14	554.	32.21	551.13
20	554.	37.22	551.15	559.	37.22	555.15	570.	49.23	567.17	574.	48.23	568.18	578.	48.23	574.19	581.	47.23	578.19
	584.	46.24	581.20	586.	46.23	580.20	590.	44.24	584.21	592.	43.24	589.22	595.	43.24	592.22	599.	43.24	598.21
21	604.	43.24	602.21	610.	44.24	608.21	620.	49.25	615.21	625.	51.25	621.21	631.	53.25	620.19	636.	55.24	624.18
	643.	56.24	630.18	648.	56.24	636.18	654.	56.24	645.17	659.	56.24	650.17	665.	56.25	663.18	671.	55.25	672.17
22	679.	54.26	681.18	690.	51.25	687.19	700.	49.25	698.19	708.	48.25	706.19	717.	46.25	711.18	724.	44.25	719.18
	732.	43.25	726.18	740.	43.25	733.18	749.	43.25	739.19	757.	42.25	747.20	767.	40.25	757.20	775.	40.25	765.20
23	785.	40.25	776.19	796.	40.25	787.19	807.	40.25	798.19	816.	39.25	808.19	825.	38.26	817.20	833.	37.26	829.20
	842.	37.26	838.20	847.	38.26	843.20	852.	39.26	848.20	856.	40.26	852.20	861.	41.26	854.21	865.	42.26	858.21

Table 5

MONTHLY AVERAGE ON PATH 2 3 FOR MONTH 6 1962

UT	AVER	SDV NO	QAV NO		+ 5 MIN			+10 MIN			+15 MIN			+20 MIN			+25 MIN	
00	887.	20.21	887.16	893.	20.21	894.15	899.	21.22	901.15	903.	22.22	904.14	908.	23.23	911.16	911.	23.23	913.17
	914.	24.23	917.15	917.	26.22	919.16	921.	28.22	922.16	923.	28.22	925.14	926.	29.22	929.14	928.	29.22	931.14
01	931.	30.22	936.15	934.	30.22	937.14	938.	30.22	941.14	940.	30.22	944.15	942.	30.22	948.16	943.	30.22	945.16
	945.	30.23	947.15	947.	30.23	949.15	948.	30.23	948.14	949.	30.23	950.14	950.	30.23	951.14	951.	30.23	952.14
02	952.	29.23	953.14	954.	29.23	954.14	955.	29.23	955.14	955.	29.23	955.14	956.	28.23	962.13	956.	27.23	962.13
	956.	27.23	956.16	954.	27.23	952.17	952.	26.23	950.17	948.	25.23	945.17	942.	24.23	939.16	938.	23.23	935.15
03	932.	23.23	928.16	924.	23.23	920.16	915.	23.23	912.16	908.	22.23	908.16	900.	21.23	899.17	894.	21.23	894.18
	888.	21.23	888.16	884.	20.23	884.16	879.	19.23	878.17	877.	19.23	875.16	875.	18.23	875.16	874.	18.23	873.17
04	872.	18.23	871.17	873.	19.23	871.15	873.	19.23	872.14	874.	19.23	871.15	875.	19.23	873.17	875.	19.23	873.17
	874.	19.23	873.17	874.	19.23	873.17	873.	20.23	871.16	872.	20.23	869.16	870.	21.23	867.16	867.	21.23	864.18
05	864.	21.23	862.17	859.	20.23	858.16	853.	20.23	853.16	847.	20.23	842.15	841.	21.23	837.14	834.	21.23	827.14
	827.	20.23	821.14	821.	20.23	815.14	815.	20.23	811.15	811.	20.23	807.15	806.	20.23	805.15	803.	20.23	802.15
06	799.	21.23	799.15	796.	20.22	795.14	793.	20.22	794.15	793.	20.22	794.15	792.	21.22	790.15	792.	21.22	789.15
	791.	22.22	788.15	790.	21.22	788.17	789.	22.22	786.15	787.	20.22	785.15	785.	20.22	784.16	782.	19.22	783.15
07	779.	18.23	780.16	771.	18.23	770.14	764.	17.24	764.14	755.	17.24	757.17	747.	17.24	746.17	740.	16.24	740.18
	732.	16.24	733.17	727.	16.24	728.17	721.	16.24	721.15	719.	17.24	720.16	716.	17.24	717.16	715.	17.24	716.16
08	714.	17.24	715.16	713.	17.24	714.16	711.	16.24	713.16	711.	16.24	712.16	710.	17.24	712.16	707.	18.24	709.16
	704.	21.24	707.16	695.	22.24	701.14	685.	25.24	689.16	672.	26.24	676.17	658.	27.24	659.17	644.	25.24	648.17
09	629.	24.24	634.16	622.	22.24	626.15	614.	21.24	614.17	613.	22.24	616.15	612.	23.24	615.15	612.	23.24	616.15
	612.	24.24	614.16	613.	25.24	615.16	614.	25.24	615.16	614.	25.24	615.16	614.	26.24	613.15	613.	28.24	608.15
10	611.	31.24	608.14	583.	25.24	578.15	555.	39.24	558.16	539.	26.24	540.15	522.	15.24	525.18	519.	13.24	521.18
	516.	12.24	516.18	514.	11.24	514.18	511.	10.24	512.19	510.	10.24	510.20	508.	9.24	509.19	507.	9.24	508.19
11	506.	8.24	507.16	506.	8.24	505.18	506.	9.24	507.16	506.	10.24	507.19	505.	11.24	507.18	505.	11.24	507.18
	505.	10.24	506.17	505.	10.24	506.17	505.	10.24	506.17	505.	9.24	506.17	505.	8.24	505.17	505.	8.24	505.15
12	505.	8.24	505.16	504.	8.24	504.16	503.	9.24	504.17	503.	10.24	504.18	503.	10.24	503.18	504.	11.24	504.18
	504.	12.24	502.18	504.	11.24	502.18	503.	11.24	501.19	503.	10.24	501.18	502.	9.24	501.18	502.	7.24	501.18
13	501.	7.24	501.19	502.	4.20	501.12	501.	4.20	500.14	501.	4.20	501.14	500.	4.20	500.11	500.	4.19	500.11
	499.	4.19	500.12	499.	4.19	500.12	499.	4.19	499.11	498.	4.19	498.12	498.	5.19	498.14	498.	4.19	498.13
14	497.	5.19	498. 9	497.	5.19	496.11	496.	5.19	495.12	495.	5.19	495.12	494.	5.20	493.14	494.	5.20	493.14
	494.	6.20	493.13	493.	6.20	492.13	493.	6.20	492.15	492.	6.20	492.17	492.	6.20	492.17	491.	5.19	491.15
15	491.	6.20	492.14	492.	4.20	492.13	493.	5.20	494.14	493.	5.20	493.15	492.	6.20	493.14	492.	7.20	492.15
	491.	7.20	491.15	492.	6.20	491.16	492.	6.20	491.15	493.	6.20	492.14	493.	6.20	492.15	493.	5.20	493.15
16	493.	5.20	493.12	494.	5.20	493.13	494.	5.20	492.13	494.	5.20	493.12	495.	5.21	495.12	495.	5.21	495.12
	494.	5.21	494.12	495.	5.21	494.11	495.	6.21	495.13	495.	6.21	496.14	495.	5.21	496.13	495.	5.21	494.11
17	495.	5.21	494.14	495.	5.21	495.12	496.	5.21	495.12	496.	5.21	496.12	497.	5.21	496.12	498.	5.21	497.13
	498.	6.21	497.15	499.	6.20	498.13	499.	6.20	499.12	500.	6.20	499.12	501.	5.20	500.13	502.	5.20	501.12
18	503.	5.20	503.14	504.	6.20	504.14	506.	7.20	506.15	506.	7.20	505.14	506.	8.20	503.16	506.	8.20	505.13
	507.	8.20	506.13	508.	8.20	507.12	509.	8.20	509.13	509.	9.20	510.11	510.	10.20	511.11	511.	10.20	510.10
19	512.	11.20	511.10	513.	11.20	512.10	514.	11.20	514.11	516.	11.20	515.11	517.	13.20	516.12	518.	13.20	517.12
	520.	13.21	519.13	521.	14.21	520.15	522.	15.21	521.15	523.	15.21	521.15	524.	16.21	523.15	527.	16.20	525.15
20	535.	29.21	529.18	537.	28.21	532.18	541.	28.21	536.18	543.	28.21	538.18	548.	29.22	542.19	550.	29.22	545.19
	553.	29.22	546.18	556.	29.22	549.18	559.	30.22	553.17	562.	30.22	555.17	566.	30.22	559.17	569.	31.22	562.17
21	572.	31.23	565.18	578.	29.23	570.19	585.	28.24	577.20	592.	28.24	583.18	599.	29.24	593.19	606.	29.24	599.17
	613.	29.24	606.19	619.	29.24	617.17	626.	31.24	624.16	631.	32.24	627.15	636.	34.24	630.14	641.	34.24	636.14
22	646.	35.24	644.15	652.	33.22	652.14	659.	33.22	659.14	668.	31.22	667.16	676.	30.23	678.16	688.	29.23	687.17
	700.	29.23	697.18	709.	29.23	706.18	720.	31.23	718.19	728.	32.23	725.19	737.	33.23	734.19	747.	32.23	741.20
23	758.	32.24	753.18	772.	31.24	765.19	786.	30.24	780.19	799.	29.24	792.20	811.	28.24	806.19	823.	26.23	818.20
	837.	25.23	834.19	849.	25.21	845.17	860.	25.21	854.17	868.	24.21	864.18	876.	24.21	873.19	884.	25.21	882.18

Table 6

MONTHLY AVERAGE ON PATH 2 3 FOR MONTH 7 1962

UT	AVER	SDV NO	QAV NO		+ 5 MIN			+10 MIN			+15 MIN			+20 MIN			+25 MIN	
00	879.	30.27	876.17	884.	30.27	880.18	889.	31.27	884.19	892.	31.27	889.18	895.	32.27	892.18	898.	32.27	897.17
	902.	34.27	900.19	905.	34.27	904.19	909.	35.27	910.18	911.	36.27	912.18	914.	36.27	911.18	915.	36.27	913.16
01	917.	37.27	915.18	920.	37.27	915.19	923.	37.27	918.19	924.	37.27	920.19	926.	37.27	923.18	928.	37.27	927.19
	930.	36.27	929.19	931.	36.27	930.19	933.	35.27	929.20	934.	35.27	931.20	936.	36.27	932.20	937.	36.27	934.20
02	938.	37.27	935.20	939.	38.27	934.19	940.	39.27	935.19	941.	39.27	935.19	941.	39.27	942.16	942.	39.27	940.17
	942.	39.27	937.19	942.	40.27	939.18	941.	41.27	941.17	940.	40.27	939.19	939.	39.27	938.19	938.	36.27	933.18
03	936.	34.27	930.18	933.	34.27	927.22	929.	34.27	925.21	925.	35.27	922.22	920.	37.27	913.24	914.	33.27	909.23
	907.	30.27	907.20	903.	30.27	902.21	899.	30.27	895.21	893.	30.27	890.20	888.	30.27	883.21	885.	32.27	879.22
04	881.	34.27	877.21	875.	31.26	874.20	872.	32.26	872.20	869.	34.26	870.20	867.	34.26	868.20	866.	35.26	866.19
	865.	36.26	864.19	866.	36.27	865.18	865.	37.27	864.18	863.	37.27	862.18	861.	37.27	864.18	859.	37.27	863.19
05	857.	36.27	860.19	854.	36.27	855.20	849.	37.27	851.20	845.	37.27	845.21	840.	38.27	844.19	836.	37.27	836.19
	831.	36.27	830.19	825.	35.27	822.20	819.	35.27	812.20	813.	34.27	806.20	806.	34.27	803.18	801.	34.27	799.20
06	795.	34.27	793.20	791.	35.27	789.18	786.	35.27	785.20	784.	35.27	784.19	782.	35.27	778.19	779.	35.27	776.19
	776.	35.27	775.20	775.	34.27	772.19	772.	34.27	770.19	771.	34.27	771.18	771.	35.27	770.18	769.	36.27	768.18
07	767.	37.27	764.19	761.	35.27	753.17	754.	35.27	746.17	747.	34.27	741.18	739.	34.27	736.18	730.	31.27	723.18
	721.	29.27	714.18	713.	28.27	709.19	705.	27.27	701.21	699.	28.27	698.19	694.	29.27	692.19	691.	29.27	692.18
08	688.	29.27	690.18	687.	29.27	690.19	686.	29.27	690.19	685.	30.27	689.19	684.	30.27	690.18	682.	31.27	686.19
	680.	32.27	683.20	676.	32.27	676.19	672.	32.27	671.19	663.	33.26	662.19	655.	35.26	652.20	644.	37.26	643.19
09	632.	39.26	630.19	620.	33.26	619.19	607.	28.26	608.20	603.	26.26	605.20	598.	24.26	599.17	597.	25.26	597.18
	594.	25.26	594.19	594.	24.26	595.20	593.	23.26	594.18	593.	23.26	595.18	593.	23.26	592.18	591.	24.26	590.18
10	588.	25.26	586.16	583.	24.25	582.16	576.	28.25	578.16	561.	27.24	561.17	544.	30.25	538.18	535.	28.25	529.20
	524.	23.26	522.19	520.	20.26	518.19	516.	20.26	513.20	513.	18.26	511.20	510.	16.26	507.20	509.	16.26	506.20
11	507.	16.26	505.18	507.	16.26	506.19	506.	17.26	505.20	507.	17.26	506.19	507.	17.26	507.20	507.	15.26	507.18
	506.	14.27	507.19	507.	14.27	507.19	507.	14.27	507.20	507.	14.27	507.20	508.	14.27	507.20	508.	14.27	506.20
12	508.	13.27	507.20	509.	13.27	507.20	508.	12.27	506.20	508.	12.27	506.20	507.	12.27	505.19	507.	13.27	506.20
	507.	14.27	506.20	506.	13.27	505.19	505.	13.27	504.19	505.	12.27	503.20	505.	12.27	503.20	504.	10.27	505.20
13	502.	9.27	504.21	501.	11.26	501.21	500.	19.26	498.22	500.	19.26	499.22	498.	21.26	500.22	501.	20.26	500.20
	502.	19.26	501.20	502.	17.26	501.20	501.	15.26	502.20	500.	13.26	500.20	498.	14.26	496.17	497.	15.26	495.17
14	497.	17.26	497.17	497.	15.26	497.20	497.	14.26	497.20	498.	14.26	497.20	498.	16.26	497.22	498.	15.26	494.21
	497.	14.26	494.21	496.	12.26	494.20	495.	11.26	493.21	494.	8.26	493.20	494.	9.26	492.19	494.	8.26	492.18
15	493.	9.26	492.18	494.	9.26	492.19	495.	9.26	492.19	495.	10.26	493.18	495.	10.26	493.18	495.	10.26	493.18
	494.	10.26	493.19	494.	10.26	493.18	494.	10.26	492.17	494.	9.26	492.18	494.	9.26	492.19	494.	9.26	492.18
16	493.	9.26	494.17	494.	8.26	494.17	494.	8.26	494.18	494.	7.26	495.19	494.	8.26	494.18	494.	8.26	494.18
	494.	8.26	495.17	494.	8.26	495.17	494.	9.26	495.17	494.	9.26	495.18	494.	9.26	494.18	494.	9.26	495.18
17	494.	8.26	494.19	494.	8.26	495.19	494.	9.26	495.20	494.	9.26	496.20	493.	12.26	496.22	494.	11.26	496.21
	494.	10.26	496.20	495.	11.26	497.20	496.	11.26	497.20	496.	11.26	497.18	497.	11.26	498.18	498.	11.26	498.18
18	498.	11.26	498.18	499.	11.26	498.20	500.	12.26	499.20	501.	12.26	499.20	501.	13.26	499.19	502.	13.26	499.19
	502.	14.26	500.20	503.	14.26	501.20	503.	14.26	503.17	504.	14.26	503.18	504.	14.26	503.18	505.	14.26	503.19
19	505.	15.26	502.18	504.	14.25	502.17	504.	14.25	502.17	504.	15.25	502.17	505.	15.25	503.17	505.	15.25	504.16
	505.	15.25	506.15	506.	15.25	506.15	505.	18.25	506.17	505.	18.25	508.18	506.	18.25	509.18	508.	17.25	509.19
20	509.	18.25	512.18	512.	18.25	512.16	514.	20.25	515.15	517.	20.25	519.16	521.	24.25	525.19	525.	26.25	527.20
	527.	30.25	529.20	530.	35.24	533.19	533.	39.24	537.17	541.	31.24	538.16	552.	31.24	544.18	560.	31.23	551.17
21	563.	28.24	557.17	568.	29.24	562.17	574.	29.25	568.18	579.	29.25	577.20	585.	29.25	582.21	591.	29.25	586.18
	595.	31.26	588.18	600.	31.26	593.18	605.	30.26	600.17	609.	31.26	609.17	613.	33.26	616.18	618.	33.26	618.20
22	625.	33.26	623.19	632.	33.26	634.21	638.	34.26	643.20	645.	35.26	649.21	653.	37.27	660.21	660.	39.27	664.19
	668.	40.27	671.19	676.	42.27	678.18	684.	46.27	684.19	696.	43.27	694.19	706.	43.27	705.19	716.	46.27	719.20
23	729.	44.27	730.20	744.	40.27	752.17	760.	43.27	770.19	775.	38.27	781.18	789.	38.27	797.20	801.	37.27	805.18
	814.	37.27	815.19	826.	35.27	825.18	838.	33.27	841.20	851.	30.27	850.20	864.	31.27	862.20	877.	33.27	877.22

Table 7

MONTHLY AVERAGE ON PATH 2 3 FOR MONTH 8 1962

UT	AVER	SDV NO	QAV NO		+ 5 MIN			+10 MIN			+15 MIN			+20 MIN			+25 MIN	
00	952.	44.24	951.16	957.	44.24	956.16	962.	43.24	963.15	965.	44.24	965.16	970.	45.24	969.16	973.	45.24	972.16
	977.	45.24	976.16	980.	45.24	982.15	983.	45.24	985.15	985.	44.24	987.15	989.	44.24	990.15	988.	44.23	986.15
01	989.	44.23	987.15	990.	45.23	995.15	991.	46.23	991.15	992.	46.23	998.17	994.	48.23	994.17	995.	48.23	998.18
	997.	48.23	1000.18	998.	48.23	1001.18	999.	48.23	1003.18	1001.	47.23	1006.17	1003.	46.23	1008.17	1003.	48.23	1006.18
02	1003.	51.23	1004.19	1003.	52.23	1005.19	1004.	52.23	1006.19	1004.	53.23	1006.19	1005.	53.23	1007.19	1005.	54.23	1007.19
	1005.	54.23	1008.19	1005.	55.23	1008.19	1005.	56.23	1008.19	1005.	55.23	1008.19	1007.	55.23	1010.19	1007.	54.23	1010.19
03	1007.	54.23	1011.19	1007.	55.22	1011.18	1008.	55.22	1012.18	1008.	56.22	1012.18	1007.	57.22	1012.18	1006.	57.22	1007.17
	1004.	58.22	1001.18	1003.	57.22	998.18	1000.	57.22	1001.16	997.	58.22	998.16	994.	60.22	1000.15	989.	64.22	995.15
04	983.	68.22	985.16	976.	71.22	980.12	970.	71.23	980.14	961.	71.23	972.14	952.	71.23	966.15	944.	69.23	956.15
	935.	68.23	941.16	927.	64.23	920.17	916.	60.24	908.19	911.	55.24	907.20	907.	52.24	904.20	904.	49.24	900.20
05	900.	47.24	897.20	899.	47.24	896.20	899.	46.24	896.20	899.	46.24	896.20	899.	46.24	896.20	899.	45.24	893.19
	899.	44.24	895.20	898.	44.24	896.19	896.	44.24	896.18	899.	39.23	897.17	895.	41.23	897.16	891.	42.23	895.17
06	885.	43.23	889.17	880.	44.23	888.16	873.	44.23	881.16	866.	40.23	872.15	857.	38.23	865.16	851.	37.23	852.15
	844.	37.23	845.15	837.	37.23	840.16	830.	37.23	835.15	826.	36.23	827.16	822.	37.23	824.16	819.	36.23	822.16
07	816.	36.23	815.15	813.	35.23	813.15	811.	35.23	810.15	809.	35.23	809.15	808.	35.23	808.15	805.	35.23	805.15
	801.	35.23	802.17	796.	35.23	795.18	789.	35.23	788.18	778.	36.23	776.18	764.	39.23	763.16	753.	38.23	751.16
08	742.	38.23	744.14	735.	36.23	734.15	728.	36.23	724.16	724.	36.23	720.16	718.	36.24	712.15	717.	36.24	711.15
	716.	35.24	710.15	714.	36.24	710.14	713.	37.24	711.13	712.	38.24	713.14	710.	39.24	709.15	706.	39.24	709.12
09	700.	41.24	700.15	685.	39.24	692.17	667.	38.24	662.16	647.	33.23	648.16	628.	31.23	627.16	617.	29.23	616.18
	609.	29.23	603.16	606.	29.23	602.15	603.	29.23	600.15	603.	28.23	599.15	603.	28.23	596.17	603.	28.23	596.17
10	604.	29.23	596.17	604.	30.23	597.16	603.	32.23	598.15	595.	34.23	587.16	585.	38.23	578.18	563.	34.23	557.18
	536.	41.24	530.18	524.	30.24	521.18	515.	23.24	513.20	511.	22.24	511.21	507.	20.24	506.20	505.	20.24	504.20
11	503.	19.24	501.21	502.	20.24	500.21	502.	20.24	500.21	502.	20.24	500.21	502.	20.24	500.21	503.	19.24	501.21
	503.	19.24	501.21	503.	18.24	502.21	503.	18.24	501.21	503.	17.24	501.21	503.	16.24	500.20	504.	16.24	501.20
12	504.	16.24	503.20	503.	14.24	502.19	503.	14.24	501.17	502.	15.24	501.18	502.	17.24	502.19	501.	17.24	503.20
	501.	17.24	501.19	501.	15.24	501.19	502.	14.24	501.19	501.	13.24	501.19	501.	11.24	501.18	500.	10.24	500.17
13	500.	9.24	500.18	500.	8.21	500.16	501.	9.21	499.16	501.	9.21	499.16	501.	10.21	499.16	500.	10.21	498.16
	500.	10.21	499.16	499.	10.21	498.17	498.	10.21	498.16	498.	9.21	497.17	497.	9.21	496.17	496.	9.21	496.17
14	496.	10.21	495.16	494.	9.20	494.16	493.	9.20	492.18	493.	9.20	492.18	492.	9.20	492.16	492.	9.20	490.16
	491.	9.20	490.16	490.	6.20	491.14	490.	5.20	489.14	490.	5.20	489.14	490.	5.20	490.12	490.	5.19	491.13
15	490.	6.19	492.12	490.	6.19	491.14	490.	6.19	491.13	490.	6.19	491.14	491.	6.19	490.14	491.	6.19	490.14
	491.	7.20	490.15	491.	7.20	491.16	491.	7.20	491.15	491.	7.20	491.15	491.	8.20	491.14	491.	8.20	491.16
16	491.	8.20	491.17	491.	8.20	491.16	492.	9.20	491.16	492.	9.20	491.17	493.	10.20	492.17	493.	10.20	493.18
	494.	10.20	493.18	494.	10.20	493.18	494.	9.20	492.17	494.	9.20	493.16	494.	9.20	493.16	494.	9.20	494.16
17	494.	10.20	494.16	495.	10.20	495.15	495.	10.20	496.14	496.	10.20	496.16	497.	10.20	497.16	497.	10.20	497.15
	498.	10.20	498.15	498.	9.20	498.16	497.	9.20	498.16	498.	9.20	499.17	498.	10.20	498.16	498.	10.20	499.16
18	499.	11.20	500.17	499.	12.20	501.17	500.	12.20	502.17	502.	12.20	503.17	503.	12.20	505.17	504.	12.20	506.17
	506.	12.20	508.17	507.	12.20	509.16	508.	11.20	509.15	509.	11.20	511.15	510.	12.20	512.15	511.	12.20	513.15
19	513.	13.20	514.15	515.	14.20	516.15	517.	15.20	516.17	519.	16.20	519.16	522.	17.20	522.16	524.	17.20	524.16
	527.	19.20	526.15	530.	20.20	531.14	534.	22.20	534.13	540.	23.20	538.11	545.	23.20	545.10	548.	27.20	543.12
20	551.	30.20	549.11	555.	32.19	551.11	561.	34.19	558.11	566.	35.18	563.10	571.	35.18	567.10	575.	36.18	575.11
	579.	37.18	584.10	585.	36.18	591. 8	595.	38.19	603.14	599.	37.19	607.14	605.	36.19	610.13	610.	36.19	618.14
21	618.	36.20	625.15	624.	35.20	628.16	632.	35.21	635.15	641.	37.20	645.14	648.	38.20	656.13	657.	40.20	664.13
	664.	41.20	669.14	671.	40.20	675.14	679.	40.20	680.15	687.	39.20	687.15	694.	38.21	694.16	701.	38.21	700.16
22	708.	38.22	705.16	716.	39.22	715.15	725.	40.22	724.15	733.	41.22	728.16	741.	41.22	736.16	750.	41.22	748.15
	758.	41.22	756.15	768.	42.22	768.16	778.	45.22	771.14	789.	45.22	785.13	801.	45.22	802.14	812.	45.22	809.13
23	824.	45.22	819.13	835.	45.22	831.13	847.	44.22	847.12	859.	43.22	856.12	871.	42.22	862.14	880.	42.22	872.14
	891.	42.22	887.13	901.	40.22	898.13	912.	39.22	909.13	919.	38.22	919.12	927.	37.22	928.12	935.	36.22	935.12

Table 8

MONTHLY AVERAGE ON PATH 2 3 FOR MONTH 9 1962

UT	AVER	SDV NO	QAV NO		+ 5 MIN			+10 MIN			+15 MIN			+20 MIN			+25 MIN	
00	955.	23.27	957.19	958.	23.27	962.20	961.	23.27	964.19	964.	23.27	969.19	967.	23.27	971.19	972.	27.27	975.20
	972.	22.27	977.19	974.	23.27	979.19	977.	22.27	981.19	979.	22.27	982.20	980.	21.27	984.20	982.	22.27	986.20
01	983.	22.27	986.21	984.	22.27	985.19	985.	22.27	988.21	987.	22.28	987.21	988.	21.28	989.22	990.	22.28	990.20
	991.	21.28	991.22	992.	22.28	993.22	993.	22.28	994.22	995.	21.28	995.20	996.	22.28	997.21	996.	22.28	997.23
02	997.	21.28	999.24	998.	22.28	1001.24	1000.	22.28	1004.23	1001.	22.28	1004.24	1001.	23.28	1005.23	1002.	23.28	1006.23
	1003.	24.28	1008.24	1004.	24.28	1010.24	1004.	24.28	1009.23	1005.	25.28	1010.23	1006.	25.28	1011.21	1007.	25.28	1012.21
03	1007.	25.28	1012.21	1008.	24.28	1015.21	1009.	24.28	1013.21	1009.	24.28	1014.21	1010.	24.28	1013.23	1010.	24.28	1013.22
	1011.	24.28	1013.21	1012.	24.28	1014.21	1014.	23.28	1015.21	1014.	23.28	1015.21	1014.	22.28	1015.21	1014.	22.28	1015.21
04	1015.	22.28	1018.21	1014.	22.28	1017.21	1014.	23.28	1017.21	1015.	23.28	1016.19	1014.	22.28	1016.22	1012.	21.28	1012.23
	1009.	22.28	1007.22	1005.	23.28	1002.21	1001.	24.28	999.22	994.	26.28	994.21	987.	30.28	986.18	978.	34.28	976.16
05	969.	34.28	966.16	959.	35.27	953.16	952.	35.27	944.14	943.	34.27	938.15	935.	34.27	924.16	929.	30.27	917.17
	922.	25.27	917.19	919.	22.27	915.20	915.	19.27	910.18	913.	17.27	909.18	912.	15.27	909.18	911.	15.27	907.19
06	911.	16.27	908.18	910.	16.27	907.18	908.	17.27	906.18	908.	18.27	907.17	906.	18.27	906.17	903.	19.27	903.18
	900.	22.27	899.17	894.	25.27	895.18	888.	27.27	888.16	880.	30.27	879.16	872.	32.27	873.15	864.	32.27	860.15
07	855.	31.27	850.15	847.	31.27	841.16	838.	29.27	836.18	830.	25.27	826.18	824.	22.27	819.20	818.	20.27	815.21
	814.	18.27	812.21	811.	18.27	809.21	808.	18.27	806.21	806.	17.27	805.20	803.	17.27	801.19	799.	17.27	798.19
08	794.	18.27	792.20	787.	21.27	787.17	780.	24.27	784.15	771.	26.27	777.16	762.	27.27	765.17	752.	26.27	750.19
	743.	23.27	739.19	736.	18.27	733.21	729.	14.27	729.18	723.	13.27	723.15	719.	12.27	719.20	716.	12.27	715.19
09	714.	13.27	714.20	711.	14.27	710.20	706.	15.27	708.19	698.	19.27	703.16	687.	22.27	695.16	672.	25.27	678.15
	651.	26.27	653.16	635.	24.27	636.15	620.	17.27	621.17	610.	11.27	610.17	606.	10.27	605.20	604.	10.27	603.19
10	603.	9.27	604.18	604.	9.27	604.20	605.	10.27	604.19	605.	9.27	604.16	598.	10.27	599.17	584.	13.27	586.19
	554.	15.27	555.16	525.	11.27	525.19	511.	8.27	511.18	507.	7.27	506.19	505.	8.27	503.22	502.	6.27	501.20
11	500.	6.27	499.20	499.	6.27	498.22	498.	5.27	497.20	498.	6.26	498.18	499.	5.26	497.20	499.	6.26	498.18
	499.	5.26	499.16	500.	5.26	499.19	502.	5.26	501.18	503.	5.26	502.18	504.	5.26	503.16	505.	4.26	505.17
12	506.	4.26	505.16	505.	4.27	505.17	505.	4.27	505.17	505.	4.27	505.16	505.	4.27	505.17	505.	4.27	505.18
	505.	4.27	505.18	506.	4.27	505.18	506.	4.27	506.20	506.	4.27	506.16	505.	4.27	505.16	505.	4.27	505.18
13	505.	5.28	503.20	504.	4.25	503.18	504.	4.24	503.17	503.	3.24	503.16	503.	4.24	503.18	503.	4.24	503.18
	504.	4.24	504.18	504.	4.24	504.17	504.	5.24	505.18	503.	6.24	504.19	502.	6.24	503.17	502.	6.24	503.18
14	501.	5.24	502.18	500.	5.24	501.18	499.	5.24	500.20	499.	5.24	500.19	499.	4.24	500.19	499.	4.24	499.19
	499.	4.24	499.20	499.	4.24	498.19	499.	4.24	498.19	498.	4.24	498.17	498.	4.24	498.17	498.	4.24	497.18
15	497.	4.24	497.20	497.	3.24	496.18	496.	3.24	496.18	496.	3.24	496.18	495.	5.24	495.18	494.	7.24	496.21
	494.	9.24	495.21	493.	10.23	495.21	493.	11.23	494.21	493.	10.23	495.21	494.	8.23	495.21	493.	7.23	494.18
16	493.	7.23	493.17	493.	6.23	494.16	493.	6.23	494.15	494.	6.23	494.15	495.	6.23	496.16	495.	5.23	495.15
	495.	5.23	495.15	495.	5.23	496.17	495.	5.23	496.15	495.	4.23	495.15	495.	5.23	495.14	496.	4.23	495.15
17	497.	4.23	497.15	497.	4.23	497.15	498.	4.23	497.17	498.	5.23	498.18	499.	6.24	499.20	500.	6.23	499.19
	501.	6.23	500.18	501.	6.22	501.17	503.	6.22	502.16	503.	6.22	503.16	504.	6.22	503.17	504.	6.22	504.16
18	505.	7.22	505.15	507.	6.22	507.17	508.	7.22	508.17	511.	8.22	511.16	513.	8.22	511.15	516.	10.22	513.16
	520.	13.22	517.19	525.	17.23	519.18	531.	19.23	524.18	536.	21.23	527.17	541.	22.23	533.16	545.	22.23	539.15
19	550.	22.24	545.15	554.	23.24	550.14	559.	21.24	556.14	565.	21.23	562.14	570.	20.23	570.16	575.	19.23	575.16
	580.	17.23	580.16	585.	15.23	586.17	590.	16.23	592.17	596.	16.23	596.16	601.	16.23	600.17	608.	16.23	608.18
20	614.	17.23	612.17	619.	19.23	616.17	625.	21.22	622.15	631.	22.22	626.16	636.	23.22	632.16	642.	23.22	636.15
	648.	22.22	644.16	654.	21.22	650.16	660.	21.22	657.16	665.	20.22	662.16	672.	19.22	671.17	678.	19.22	676.16
21	684.	19.23	683.17	692.	20.25	690.19	698.	21.25	698.18	706.	21.25	703.17	714.	22.26	710.17	720.	23.27	714.20
	727.	23.27	723.21	736.	23.27	734.20	743.	23.28	741.21	749.	23.28	748.21	756.	23.28	754.22	764.	21.28	762.22
22	772.	22.28	770.22	780.	23.28	777.20	788.	23.28	784.21	798.	24.28	794.21	806.	25.28	802.21	816.	25.28	812.21
	828.	26.28	823.20	837.	26.28	832.18	846.	26.28	845.20	856.	25.28	856.22	864.	24.28	865.21	873.	22.28	875.22
23	880.	20.28	882.20	888.	21.28	891.23	896.	19.28	898.21	903.	20.26	905.20	910.	21.26	913.19	918.	22.26	921.17
	925.	22.27	928.19	933.	23.27	935.19	939.	23.27	941.19	944.	23.27	948.20	948.	24.27	952.20	952.	24.27	957.18

Table 9

MONTHLY AVERAGE ON PATH 2 3 FOR MONTH 10 1962

UT	AVER	SDV NO	QAV NO		+ 5 MIN			+10 MIN			+15 MIN			+20 MIN			+25 MIN	
00	961.	45.28	963.21	963.	46.28	965.21	966.	46.28	968.21	968.	46.28	970.21	971.	46.28	970.22	974.	46.28	973.22
	975.	47.28	974.22	977.	47.28	975.22	979.	48.28	977.22	980.	48.28	978.22	981.	49.28	979.22	982.	49.28	982.21
01	983.	49.28	984.21	985.	50.28	985.21	987.	49.28	988.21	988.	50.28	990.21	990.	51.28	991.21	991.	51.28	991.21
	992.	51.28	993.21	993.	51.28	994.21	995.	52.28	999.20	996.	52.28	1002.21	996.	52.28	1003.21	997.	52.28	1002.22
02	998.	52.28	998.20	1004.	41.27	1006.17	1004.	41.27	1007.16	1004.	41.27	1007.18	1004.	41.27	1007.18	1004.	42.27	1005.17
	1004.	42.27	1005.17	1004.	42.27	1005.17	1005.	42.27	1008.18	1005.	43.27	1007.18	1005.	44.27	1007.18	1005.	44.27	1007.18
03	1002.	43.26	1006.18	1002.	44.26	1001.18	1003.	45.26	1000.17	1003.	44.26	999.17	1004.	44.26	999.17	1004.	45.26	998.17
	1004.	44.26	998.17	1004.	44.26	998.17	1004.	43.26	999.17	1004.	43.26	998.17	1003.	43.26	997.17	1002.	43.26	996.17
04	1001.	43.26	996.17	1001.	42.26	998.18	999.	41.26	997.18	999.	40.26	996.18	999.	40.26	996.18	998.	40.26	995.18
	997.	40.26	993.18	997.	40.26	993.18	996.	40.26	992.18	995.	40.26	994.19	994.	41.26	990.18	993.	41.26	991.19
05	993.	41.26	988.18	992.	41.26	990.17	990.	39.26	986.20	988.	38.26	985.19	985.	38.26	983.19	983.	38.26	978.16
	978.	38.26	977.17	973.	36.26	972.17	964.	34.26	965.17	957.	32.26	957.16	950.	33.26	953.17	941.	33.26	946.18
06	933.	31.26	937.18	925.	30.25	926.16	919.	29.25	921.16	913.	29.25	915.16	910.	29.25	911.17	908.	29.25	910.17
	905.	29.25	908.16	903.	29.25	906.16	898.	28.25	901.16	896.	29.25	901.15	892.	28.25	898.18	888.	28.25	893.18
07	882.	28.26	887.19	876.	27.26	879.18	871.	27.26	875.20	866.	27.26	867.18	859.	27.26	855.16	851.	29.26	845.17
	844.	31.26	835.17	836.	30.26	829.18	828.	32.26	824.19	821.	32.26	818.16	814.	32.26	814.17	809.	31.26	809.17
08	804.	31.27	803.15	799.	31.27	803.17	796.	29.27	799.17	792.	28.27	794.17	788.	28.27	787.17	780.	25.26	782.15
	774.	26.26	773.15	768.	25.26	768.18	759.	26.26	755.18	749.	27.26	745.18	739.	27.26	735.18	730.	27.26	726.18
09	722.	25.27	722.17	715.	23.27	713.16	710.	21.27	709.15	707.	20.27	707.16	704.	20.27	705.16	700.	21.27	699.16
	694.	25.27	695.16	683.	28.27	681.15	668.	35.27	657.14	648.	37.27	636.14	626.	32.27	616.18	613.	23.27	611.16
10	606.	19.27	605.17	604.	18.27	603.17	603.	16.27	602.17	602.	16.27	601.17	597.	18.27	596.18	585.	22.27	587.20
	551.	24.27	548.15	519.	14.27	517.16	509.	13.27	506.19	505.	12.27	502.18	502.	12.27	499.16	499.	11.27	498.18
11	497.	11.27	496.20	496.	11.27	493.20	496.	10.27	493.19	497.	10.27	494.19	497.	10.27	495.18	497.	8.27	495.19
	498.	7.27	497.17	499.	6.27	499.20	499.	7.27	499.21	500.	7.27	500.23	502.	8.27	501.22	502.	8.27	501.22
12	504.	8.28	504.23	504.	9.28	504.23	505.	10.28	505.23	506.	11.28	506.24	506.	10.28	506.25	506.	8.28	506.22
	505.	8.28	506.20	505.	7.28	506.21	505.	7.28	506.21	505.	8.28	506.20	505.	8.28	507.18	505.	9.28	506.17
13	505.	9.28	505.17	504.	9.26	506.17	504.	9.26	505.19	505.	10.25	506.17	505.	10.25	505.18	504.	10.25	505.17
	504.	9.25	504.18	504.	9.25	504.18	504.	9.25	504.18	503.	9.25	504.18	503.	9.25	504.18	502.	8.25	503.19
14	502.	8.26	502.21	501.	8.26	502.20	501.	8.26	501.21	501.	8.26	501.21	500.	9.26	501.20	500.	9.26	501.20
	500.	9.26	500.20	499.	9.26	500.21	498.	8.26	499.21	498.	8.26	499.21	498.	8.26	499.21	498.	7.26	498.20
15	497.	7.26	498.19	497.	5.26	498.20	497.	5.26	497.18	497.	5.25	497.17	497.	6.25	498.15	496.	6.25	497.17
	495.	8.25	497.18	495.	8.25	496.18	494.	8.25	496.19	495.	7.25	496.19	495.	8.25	496.19	495.	8.25	496.18
16	495.	8.25	495.18	495.	9.25	496.19	495.	9.25	496.19	495.	9.25	496.18	496.	10.25	497.18	496.	10.25	497.18
	496.	10.25	497.18	496.	11.25	497.18	497.	11.25	496.19	498.	12.25	497.19	499.	12.25	498.20	500.	13.25	499.21
17	502.	14.25	500.21	503.	14.25	501.21	504.	14.25	501.19	506.	14.25	504.18	509.	16.25	504.19	512.	16.25	507.19
	516.	17.25	511.17	521.	17.25	520.14	527.	18.25	526.14	532.	19.25	535.15	538.	19.25	543.17	544.	19.25	547.18
18	548.	19.25	551.16	553.	18.24	556.15	559.	20.24	562.15	565.	20.24	565.13	571.	19.24	570.16	576.	19.24	577.18
	579.	20.24	580.18	583.	21.24	585.19	586.	20.24	587.19	588.	19.23	587.17	590.	19.22	589.16	592.	18.22	592.16
19	596.	18.23	595.17	601.	18.23	598.16	606.	19.23	605.17	610.	20.23	606.15	618.	22.23	612.15	623.	23.23	618.15
	628.	24.23	624.15	635.	24.24	630.15	640.	24.25	637.17	648.	23.26	647.17	654.	23.26	657.15	660.	24.25	663.17
20	666.	23.26	671.16	672.	22.26	676.16	678.	22.26	681.16	683.	21.26	681.16	688.	22.26	689.18	693.	22.25	694.17
	699.	22.25	702.19	705.	22.25	708.19	711.	23.25	714.19	716.	24.25	719.19	721.	24.25	724.19	727.	24.24	731.18
21	725.	57.26	730.23	732.	58.26	737.23	739.	58.27	744.24	745.	57.27	750.24	751.	57.27	756.24	756.	57.27	764.25
	762.	57.27	770.25	769.	57.27	777.25	777.	56.28	785.26	785.	56.28	793.26	794.	54.28	801.26	802.	55.28	809.26
22	809.	53.28	818.25	819.	53.29	831.25	827.	53.29	839.25	835.	52.29	845.24	842.	52.28	853.23	850.	51.28	860.23
	857.	51.28	869.24	864.	51.28	878.25	871.	52.28	885.25	877.	51.28	887.25	885.	50.28	893.24	893.	51.28	902.25
23	901.	50.28	910.25	909.	50.28	918.25	917.	50.28	926.25	924.	49.28	934.25	931.	49.28	938.24	936.	50.28	945.25
	941.	49.29	952.25	946.	49.29	957.25	949.	50.29	960.25	952.	49.29	963.25	954.	49.29	966.25	957.	50.29	968.25

Table 10

MONTHLY AVERAGE ON PATH 2 3 FOR MONTH 11 1962

UT	AVER	SDV NO	QAV NO		+ 5 MIN			+10 MIN			+15 MIN			+20 MIN			+25 MIN	
00	896.	77.27	910.26	898.	78.27	912.26	900.	79.27	915.26	901.	79.27	916.26	902.	79.27	917.26	903.	80.27	918.26
	904.	80.27	919.26	905.	80.27	920.26	906.	80.27	921.26	906.	80.27	921.26	907.	81.27	922.26	908.	81.27	923.26
01	908.	81.27	923.26	908.	81.27	924.26	909.	81.27	924.26	909.	81.27	924.26	910.	81.27	925.26	909.	81.27	925.26
	909.	81.27	924.26	909.	81.27	925.26	909.	82.27	925.26	910.	81.27	925.26	910.	81.27	925.26	910.	81.27	925.26
02	910.	81.27	925.26	910.	82.27	925.26	909.	82.27	925.26	910.	83.27	925.26	910.	83.27	926.26	910.	84.27	926.26
	910.	84.27	926.26	910.	85.27	926.26	910.	85.27	925.26	909.	85.27	925.26	909.	84.28	924.27	909.	84.28	924.27
03	908.	84.28	924.27	908.	84.28	923.27	908.	83.28	920.26	907.	83.28	920.26	907.	83.28	919.26	907.	83.28	919.26
	907.	82.28	919.26	907.	83.28	919.26	906.	83.28	919.26	906.	83.28	921.27	905.	83.28	921.27	904.	83.28	920.27
04	903.	83.28	918.27	902.	83.28	917.27	902.	83.28	917.27	901.	82.28	916.27	901.	81.28	915.27	900.	81.28	915.27
	900.	80.28	915.27	900.	80.28	912.26	901.	79.28	912.26	901.	79.28	912.26	900.	79.28	912.26	900.	79.28	912.26
05	900.	79.28	911.26	899.	79.28	911.26	898.	79.28	910.26	898.	79.28	910.26	898.	79.28	909.26	897.	79.28	909.26
	897.	79.28	909.26	896.	79.28	911.27	896.	79.28	910.27	895.	79.28	910.27	894.	79.28	909.27	895.	78.28	910.27
06	896.	77.28	910.27	895.	77.28	910.27	895.	76.28	909.27	893.	76.28	907.27	891.	76.28	905.27	888.	76.28	902.27
	885.	76.28	899.27	881.	75.28	895.27	877.	74.28	890.27	873.	74.28	886.27	869.	74.28	882.27	864.	74.28	878.27
07	859.	75.28	873.27	855.	75.28	866.26	851.	75.28	862.26	846.	75.28	857.26	841.	74.28	854.27	837.	74.28	851.27
	833.	74.28	846.27	830.	74.28	843.27	826.	74.28	839.27	823.	73.28	837.27	821.	73.28	834.27	818.	73.28	831.27
08	814.	72.28	827.27	810.	74.27	823.26	805.	75.27	819.26	801.	76.27	814.26	796.	77.27	807.25	791.	76.27	804.26
	785.	76.27	798.26	780.	77.26	794.25	774.	76.26	788.25	770.	75.26	784.25	766.	74.26	780.25	762.	74.26	776.25
09	758.	72.27	772.26	753.	72.27	766.26	745.	72.28	758.27	735.	73.28	746.26	725.	75.28	735.26	715.	74.28	725.26
	704.	74.28	715.26	698.	72.28	711.27	691.	72.28	704.27	685.	72.28	698.27	679.	72.28	692.27	665.	72.28	678.27
10	650.	73.28	663.27	639.	43.28	644.24	627.	23.28	626.18	617.	17.28	618.21	606.	14.28	607.19	597.	18.28	600.22
	588.	24.28	592.23	563.	30.28	562.21	538.	41.29	535.22	524.	26.29	518.19	509.	15.29	505.18	502.	11.28	501.19
11	493.	10.28	492.18	490.	10.28	489.18	487.	11.28	486.18	486.	11.28	485.20	485.	11.28	483.19	485.	11.28	485.20
	486.	11.28	485.20	487.	11.28	487.20	489.	11.28	488.21	490.	10.28	490.21	492.	10.28	492.21	493.	10.28	492.20
12	495.	9.28	493.19	497.	8.28	495.19	499.	8.28	498.19	499.	7.28	500.20	500.	7.28	500.20	501.	7.28	501.21
	502.	7.29	501.22	502.	7.29	502.22	503.	7.29	502.23	503.	6.29	502.23	503.	6.29	503.23	503.	6.29	503.23
13	503.	6.29	503.23	504.	6.25	504.20	504.	7.25	504.20	503.	4.24	504.18	503.	5.24	503.20	503.	4.24	503.19
	502.	5.24	503.17	501.	5.23	501.18	501.	6.23	501.20	501.	6.23	501.20	500.	6.23	501.19	500.	6.23	500.18
14	500.	6.23	499.17	500.	6.22	499.17	500.	6.22	501.14	500.	6.22	499.15	500.	5.22	499.15	500.	5.22	500.16
	500.	6.22	500.14	500.	5.22	501.13	501.	5.23	500.15	501.	5.23	500.16	500.	5.23	499.17	500.	5.23	499.17
15	499.	6.23	498.18	499.	6.23	499.17	498.	6.23	499.15	498.	6.23	498.14	498.	6.24	497.15	498.	7.24	497.14
	498.	7.25	498.16	498.	7.25	498.16	499.	8.25	498.17	499.	9.25	498.18	499.	10.25	500.19	500.	11.25	500.18
16	501.	12.25	502.15	503.	13.25	502.16	505.	15.25	504.16	506.	15.25	505.17	509.	16.25	507.17	510.	16.25	509.17
	513.	17.25	512.19	515.	18.25	516.19	517.	19.25	519.18	519.	19.25	522.18	521.	19.25	525.18	523.	20.25	528.16
17	526.	21.25	531.17	528.	22.25	533.17	531.	22.25	536.17	533.	22.25	536.18	535.	22.25	539.18	537.	23.25	541.18
	539.	23.25	544.19	542.	24.25	547.19	545.	24.25	550.19	547.	25.25	553.19	551.	25.25	557.20	554.	26.25	561.20
18	558.	27.25	565.20	562.	28.25	568.21	567.	30.25	575.20	571.	30.25	578.19	575.	30.25	580.20	580.	30.25	583.19
	584.	30.25	589.18	589.	30.25	594.18	593.	30.25	600.19	598.	30.25	602.20	602.	30.25	607.20	605.	31.25	610.20
19	609.	31.25	614.20	612.	32.25	617.20	615.	32.25	621.20	619.	32.25	623.19	623.	32.25	626.19	627.	33.25	632.18
	631.	33.25	637.18	635.	34.25	642.18	640.	35.25	647.18	645.	35.25	653.19	650.	36.25	656.20	655.	36.25	658.20
20	662.	37.26	665.21	667.	37.26	674.21	672.	37.27	679.22	677.	37.27	683.22	681.	37.27	688.22	686.	37.27	693.22
	691.	37.27	696.23	695.	37.27	700.23	699.	37.28	706.25	703.	37.28	710.25	708.	37.28	715.25	713.	37.28	720.25
21	719.	37.28	726.25	725.	37.28	732.25	732.	37.29	739.26	738.	36.29	745.26	745.	36.29	751.26	751.	37.29	758.26
	758.	38.29	765.26	765.	38.29	772.26	772.	38.29	780.27	778.	38.29	784.28	785.	39.29	790.27	790.	39.29	797.28
22	797.	39.29	803.28	803.	39.29	810.28	810.	39.29	817.28	817.	38.29	824.28	825.	38.29	831.28	831.	39.29	837.28
	837.	40.29	844.28	843.	40.29	850.28	850.	41.29	857.28	856.	41.29	863.28	862.	42.29	870.28	867.	43.29	875.28
23	873.	43.29	881.28	878.	44.29	885.28	883.	44.29	890.28	886.	44.29	893.28	889.	44.29	897.28	891.	45.29	898.28
	893.	46.29	900.28	895.	46.28	903.27	897.	46.28	905.27	899.	47.28	907.27	901.	48.28	909.27	903.	48.28	911.27

Table 11

MONTHLY AVERAGE CN PATH 2 3 FOR MONTH 12 1962

UT	AVER	SDV NO	QAV NO		+ 5 MIN			+10 MIN			+15 MIN			+20 MIN			+25 MIN	
00	888.	36.30	892.25	890.	37.30	895.24	892.	37.30	897.23	894.	37.30	898.23	895.	37.30	897.24	897.	37.30	897.23
	899.	37.30	899.23	900.	37.30	902.22	902.	37.30	903.22	905.	37.30	904.21	907.	37.30	905.20	908.	37.30	906.20
01	909.	38.30	910.21	910.	38.30	910.21	911.	39.30	915.23	911.	39.30	914.22	911.	39.30	914.22	912.	39.30	917.23
	913.	39.30	917.23	915.	39.30	917.22	916.	39.30	919.22	917.	39.30	919.22	917.	38.30	920.22	917.	38.30	920.22
02	918.	38.30	920.22	918.	37.30	921.22	918.	37.30	921.22	918.	37.30	920.21	919.	38.30	921.21	919.	38.30	921.21
	920.	38.30	922.21	920.	38.30	923.21	920.	38.30	927.23	921.	38.30	927.23	921.	38.30	929.24	921.	38.30	927.23
03	920.	38.30	925.22	920.	37.30	927.23	920.	37.30	928.22	920.	36.30	926.21	920.	34.30	924.20	919.	34.30	924.20
	919.	34.30	924.20	919.	34.30	923.20	918.	33.30	919.18	918.	33.30	919.20	918.	33.30	918.20	917.	33.30	917.20
04	916.	32.30	915.20	917.	32.30	916.20	917.	32.30	915.19	917.	31.30	918.21	917.	31.30	917.21	917.	31.30	917.21
	917.	31.30	918.20	917.	31.30	918.18	916.	31.30	916.17	916.	31.30	915.19	915.	30.30	914.19	914.	30.30	915.20
05	913.	30.30	915.19	912.	30.30	915.18	911.	31.30	914.18	911.	31.30	912.19	910.	30.30	911.21	909.	30.30	913.19
	907.	30.30	910.18	907.	31.30	908.19	906.	31.30	907.21	906.	32.30	905.20	906.	33.30	905.20	904.	34.30	903.19
06	903.	35.30	904.20	903.	35.30	903.19	904.	36.30	905.20	904.	36.30	906.20	904.	37.30	908.19	903.	37.29	904.19
	902.	38.29	905.20	900.	36.29	902.19	898.	35.29	900.19	896.	34.29	897.19	893.	34.29	895.21	889.	33.29	888.19
07	886.	32.30	885.20	882.	31.30	883.21	878.	31.30	879.22	874.	27.29	875.20	867.	26.29	868.20	862.	26.29	863.20
	855.	26.29	857.20	850.	27.29	851.20	844.	29.31	844.22	839.	29.31	839.22	834.	30.31	833.23	831.	29.31	832.22
08	828.	30.31	827.21	826.	30.31	824.22	824.	31.31	823.22	823.	31.31	821.21	822.	31.31	821.22	821.	30.31	818.21
	819.	29.31	818.22	815.	28.31	813.21	810.	26.31	810.22	804.	27.30	804.21	796.	28.30	798.20	790.	30.30	794.21
09	784.	32.30	787.20	781.	32.30	784.22	777.	33.30	780.23	774.	33.30	776.23	770.	33.30	771.23	764.	32.30	765.23
	757.	32.30	758.23	748.	32.30	749.23	738.	33.31	741.21	729.	34.31	733.22	719.	35.31	724.22	711.	33.31	713.24
10	703.	33.31	704.24	697.	33.31	693.25	690.	34.31	684.23	674.	38.31	672.22	658.	44.31	656.21	641.	42.30	635.23
	626.	42.30	617.23	616.	36.30	612.25	605.	32.30	604.24	590.	33.30	588.24	574.	34.30	575.22	549.	35.29	539.20
11	526.	41.29	515.20	516.	32.28	507.21	502.	25.28	496.21	494.	17.28	493.22	488.	16.29	486.22	485.	13.29	485.21
	482.	11.29	482.20	483.	10.29	483.21	485.	11.29	484.19	486.	10.29	486.19	489.	10.29	488.20	491.	9.29	490.18
12	494.	8.30	495.18	496.	8.30	497.17	499.	9.30	500.18	500.	8.30	502.19	502.	8.30	503.18	503.	8.30	504.19
	503.	8.30	505.20	504.	7.30	505.20	504.	7.30	505.22	504.	7.30	505.20	504.	7.30	504.21	503.	7.30	504.22
13	502.	7.30	503.24	502.	5.26	502.17	502.	4.26	501.19	501.	4.26	501.18	501.	4.26	501.16	500.	4.26	500.18
	499.	4.26	499.18	498.	4.26	499.17	497.	4.26	497.18	497.	4.26	496.18	497.	4.26	496.18	496.	3.26	495.19
14	495.	3.26	495.18	495.	3.26	495.16	495.	3.26	495.17	494.	3.26	495.18	494.	4.27	495.18	495.	4.27	495.16
	495.	4.27	495.19	495.	4.27	495.18	495.	5.27	495.20	495.	5.27	495.19	496.	6.27	495.19	496.	6.27	496.18
15	496.	6.27	496.19	497.	6.27	497.22	498.	7.27	499.21	499.	6.27	499.21	500.	6.27	500.21	501.	6.27	501.20
	502.	6.27	502.21	502.	6.26	503.18	504.	6.26	503.16	506.	6.26	506.19	509.	7.26	509.19	511.	7.26	512.21
16	514.	7.26	513.18	518.	6.26	517.19	522.	7.26	520.18	525.	7.26	524.16	529.	7.26	529.17	530.	8.26	530.17
	532.	9.27	532.16	535.	10.27	533.18	537.	11.27	537.16	538.	11.27	537.17	540.	11.27	539.17	541.	12.27	540.18
17	543.	13.27	543.18	545.	13.27	543.18	547.	13.27	546.18	549.	14.27	547.18	551.	15.27	551.19	554.	15.27	555.18
	558.	17.27	557.17	561.	17.27	560.16	564.	17.27	564.16	568.	17.27	567.17	572.	18.27	571.17	575.	18.27	575.18
18	578.	18.27	578.18	583.	19.27	584.19	587.	19.27	588.19	590.	19.27	591.19	594.	20.27	595.20	597.	19.27	598.20
	600.	19.27	601.20	602.	18.27	603.21	605.	18.27	604.20	608.	18.27	609.20	611.	18.27	612.18	613.	18.27	614.18
19	616.	18.27	618.19	620.	18.27	623.18	624.	18.27	628.18	628.	18.27	632.18	632.	18.27	635.19	636.	18.27	638.18
	641.	19.27	644.19	646.	19.27	648.20	651.	19.27	654.20	656.	19.27	659.22	662.	20.27	664.21	667.	20.27	668.21
20	671.	20.27	672.20	675.	21.27	674.20	680.	22.27	681.22	684.	22.27	684.22	689.	23.27	689.22	693.	23.27	693.22
	689.	55.28	699.25	693.	55.28	703.25	697.	55.28	708.25	702.	55.28	712.25	708.	55.28	718.25	712.	55.27	723.24
21	708.	79.28	726.25	715.	80.28	736.26	724.	80.29	744.27	731.	80.29	751.27	739.	80.29	759.27	745.	81.29	765.27
	751.	81.29	772.27	757.	81.29	777.27	764.	80.30	784.28	769.	80.30	789.28	775.	79.30	795.28	779.	79.30	799.28
22	784.	79.30	804.28	790.	78.30	809.28	796.	78.30	815.28	801.	77.30	820.28	807.	77.30	826.28	812.	78.30	831.28
	817.	78.30	836.28	821.	78.30	840.28	826.	78.30	845.28	831.	78.30	850.28	836.	79.30	856.28	841.	79.30	860.28
23	846.	79.30	865.28	850.	79.30	869.28	854.	79.30	873.28	857.	79.30	876.28	860.	80.30	879.28	862.	80.30	879.27
	864.	80.30	881.27	865.	80.30	882.27	866.	81.30	883.27	868.	81.30	885.27	869.	82.30	886.27	871.	82.30	887.27

Table 12

Table 13
RMS Phase differences (in degrees) between observations
Separated by time T

		T (minutes)								
Month 1962	Time	10	20	30	40	50	60	70	80	90
Jan.	Night	8°	13°	16°	19°	21°	22°	23°	24°	25°
	Day	6°	10°	17°	19°	23° *	22° *	22° *	22° *	21° *
July	Night	21°	38°	50°	64°	74° +	83° +	91° +	97° +	103° +
	Day	7°	11°	12°	14°	16°	19°	22°	24°	25°

* unreliable because of short duration of daylight.

\+ unreliable because of short duration of darkness.

THE NATIONAL BUREAU OF STANDARDS

The scope of activities of the National Bureau of Standards at its major laboratories in Washington, D.C., and Boulder, Colorado, is suggested in the following listing of the divisions and sections engaged in technical work. In general, each section carries out specialized research, development, and engineering in the field indicated by its title. A brief description of the activities, and of the resultant publications, appears on the inside of the front cover.

WASHINGTON, D. C.

Electricity. Resistance and Reactance. Electrochemistry. Electrical Instruments. Magnetic Measurements. Dielectrics. High Voltage. Absolute Electrical Measurements.

Metrology. Photometry and Colorimetry. Refractometry. Photographic Research. Length. Engineering Metrology. Mass and Volume.

Heat. Temperature Physics. Heat Measurements. Cryogenic Physics. Equation of State. Statistical Physics.

Radiation Physics. X-ray. Radioactivity. Radiation Theory. High Energy Radiation. Radiological Equipment. Nucleonic Instrumentation. Neutron Physics.

Analytical and Inorganic Chemistry. Pure Substances. Spectrochemistry. Solution Chemistry. Standard Reference Materials. Applied Analytical Research. Crystal Chemistry.

Mechanics. Sound. Pressure and Vacuum. Fluid Mechanics. Engineering Mechanics. Rheology. Combustion Controls.

Polymers. Macromolecules: Synthesis and Structure. Polymer Chemistry. Polymer Physics. Polymer Characterization. Polymer Evaluation and Testing. Applied Polymer Standards and Research. Dental Research.

Metallurgy. Engineering Metallurgy. Metal Reactions. Metal Physics. Electrolysis and Metal Deposition.

Inorganic Solids. Engineering Ceramics. Glass. Solid State Chemistry. Crystal Growth. Physical Properties. Crystallography.

Building Research. Structural Engineering. Fire Research. Mechanical Systems. Organic Building Materials. Codes and Safety Standards. Heat Transfer. Inorganic Building Materials. Metallic Building Materials.

Applied Mathematics. Numerical Analysis. Computation. Statistical Engineering. Mathematical Physics. Operations Research.

Data Processing Systems. Components and Techniques. Computer Technology. Measurements Automation. Engineering Applications. Systems Analysis.

Atomic Physics. Spectroscopy. Infrared Spectroscopy. Far Ultraviolet Physics. Solid State Physics. Electron Physics. Atomic Physics. Plasma Spectroscopy.

Instrumentation. Engineering Electronics. Electron Devices. Electronic Instrumentation. Mechanical Instruments. Basic Instrumentation.

Physical Chemistry. Thermochemistry. Surface Chemistry. Organic Chemistry. Molecular Spectroscopy. Elementary Processes. Mass Spectrometry. Photochemistry and Radiation Chemistry.

Office of Weights and Measures.

BOULDER, COLO.

CRYOGENIC ENGINEERING LABORATORY

Cryogenic Processes. Cryogenic Properties of Solids. Cryogenic Technical Services. Properties of Cryogenic Fluids.

CENTRAL RADIO PROPAGATION LABORATORY

Ionosphere Research and Propagation. Low Frequency and Very Low Frequency Research. Ionosphere Research. Prediction Services. Sun-Earth Relationships. Field Engineering. Radio Warning Services. Vertical Soundings Research.

Troposphere and Space Telecommunications. Data Reduction Instrumentation. Radio Noise. Tropospheric Measurements. Tropospheric Analysis. Spectrum Utilization Research. Radio-Meteorology. Lower Atmosphere Physics.

Radio Systems. Applied Electromagnetic Theory. High Frequency and Very High Frequency Research. Frequency Utilization. Modulation Research. Antenna Research. Radiodetermination.

Upper Atmosphere and Space Physics. Upper Atmosphere and Plasma Physics. High Latitude Ionosphere Physics. Ionosphere and Exosphere Scatter. Airglow and Aurora. Ionospheric Radio Astronomy.

RADIO STANDARDS LABORATORY

Radio Standards Physics. Frequency and Time Disseminations. Radio and Microwave Materials. Atomic Frequency and Time-Interval Standards. Radio Plasma. Microwave Physics.

Radio Standards Engineering. High Frequency Electrical Standards. High Frequency Calibration Services. High Frequency Impedance Standards. Microwave Calibration Services. Microwave Circuit Standards. Low Frequency Calibration Services.

Joint Institute for Laboratory Astrophysics - NBS Group (Univ. of Colo.).

DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS